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CIVIL AIR REGULATIONS
FOR
A-AND-E MECHANICS

REQUIREMENTS FOR C.A.A. CERTIFICATION

Revised to Feb. 1, 1946

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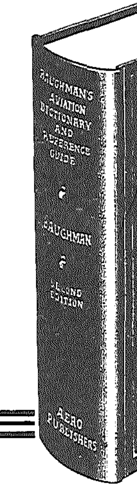

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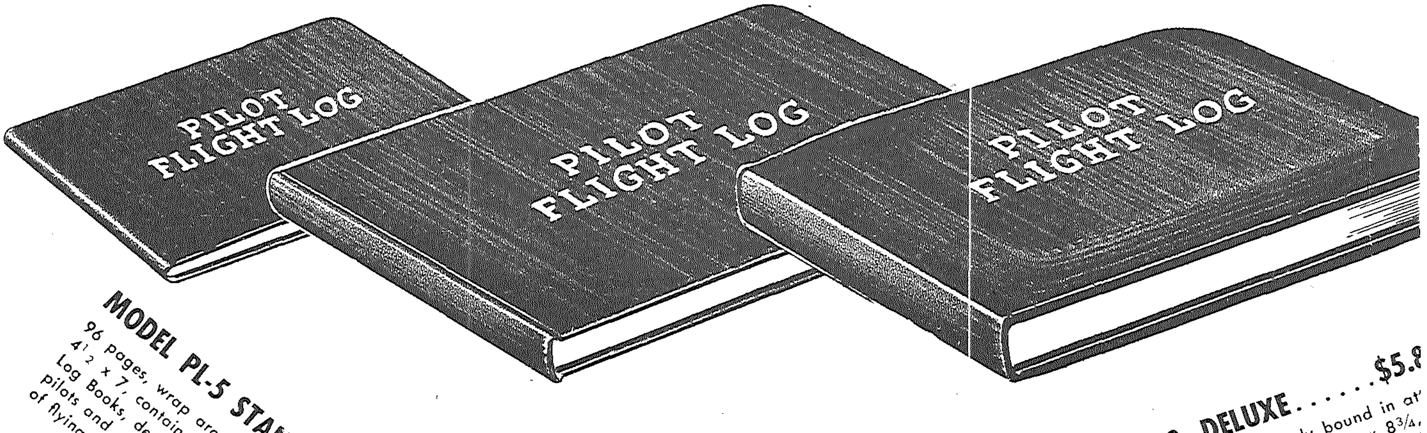

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PREFACE

This publication has been designed to fill a specific need and a long-standing demand for complete sets of Civil Air Regulations for A and E mechanics.

All of the Civil Air Regulations (Parts) pertaining to A and E Mechanics and required by the Civil Aeronautics Administration are faithfully reproduced in their entirety from the latest issues available. The only exception is the Civil Air Regulations, Part 03, AIRPLANE AIRWORTHINESS—Normal, Utility, Acrobatics and Restricted Purpose Categories, and Part 04, AIRPLANE AIRWORTHINESS—Transport Categories. Because of the similarity of these parts and their engineering contents, they are not reproduced in their entirety. Excerpts are taken from them which apply direction to the aircraft mechanic.

A conscientious attempt is made to maintain this manual in an up-to-date status. The Civil Air Regulations contained in this book are an important part of all examination subjects covered by examinations given to aircraft mechanics by the Civil Aeronautics Administration.

All late amendments to the Civil Air Regulations produced herein will be found in Section XII of this book. New amendments will be inserted at the time they are adopted by the Civil Aeronautics Board.

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INTRODUCTION

The field of aviation mechanics is broad and offers many exceptional opportunities to those persons who will expend the necessary time and energy to properly equip themselves for the many specialized types of work.

The best opportunities lie in specialization on operations such as welding, electrical instrument work, and others which require more effort for proper handling than many persons will expend.

When preparing to obtain a mechanic's certificate, you should keep in mind the fact that merely passing the Civil Aeronautics examination does not in itself constitute a final issue but is, in fact, only the first rung in the ladder of achievement.

The obtaining of a Civil Aeronautics Administration certificate is a very important step and for your own benefit you should desire to pass the written examination by reason of thorough study and preparation rather than by attempting to memorize a series of answers to questions supposedly taken from former Civil Aeronautics Administration examinations. Both when preparing to obtain your Civil Aeronautics Administration certificate and when later working on the job, make yourself realize it is fun to learn and to know the right and accepted methods of doing your work.

A survey of the average difficulties encountered by persons failing to pass the examinations for aircraft mechanics indicates that aircraft mechanics have not sufficiently mastered the subjects of simple mathematics, rigging and assembly, hydraulics and the old question of weight and balance of an airplane.

These subjects are given special consideration in our two publications "Aircraft Engine Mechanic's Study Guide" and "Aircraft Mechanic's Study Guide."

The following information concerning requirements for Certification and Rating of Aircraft and Aircraft Engine mechanics, and related publications and sources of information are compiled in the interest of persons desiring such certificates:

EXCERPT FROM PART 24 CIVIL AIR REGULATIONS (as amended to July 1, 1943)

Section—24.10 AGE. Applicant shall be at least 18 years of age.

24.11 CHARACTER. Applicant shall be of good moral character.

24.12 CITIZENSHIP. Applicant shall be:

(a) A citizen of and of unquestionable loyalty to the United States, or

(b) A person who is in sympathy with the objectives of the United States and who is a trustworthy citizen of a friendly foreign government not under the domination of or associated with any government with which the United States is at war.

24.13 EDUCATION. Applicant shall be able to read, write, speak, and understand the English language; Provided, however, That this requirement shall not apply to an applicant employed by an air carrier outside the United States, and that Airman Rating Records issued to such applicants as may be unable to read, write, speak, or understand the English language shall bear the following notation: 'Valid only outside the United States while employed by an air carrier.'

AIRCRAFT MECHANIC RATING.

24.20 AIRCRAFT MECHANIC RATING. To be eligible for an aircraft mechanic rating, an applicant shall comply with the following requirements.

24.200 AERONAUTICAL KNOWLEDGE. Applicant shall have theoretical and practical knowledge of aircraft structure and rigging, including the control systems, and aircraft appliances, shall know how properly to inspect, maintain, and repair the same, and shall be generally familiar with the provisions of Parts 03* and 15, and thoroughly familiar with the provisions of section 43.1, 43.2 and 43.3 and the provisions of Part 01 dealing with aircraft airworthiness, and the provisions of Parts 18 and 24.

24.201 AERONAUTICAL EXPERIENCE. Applicant shall have had at least 1 year of practical experience, or what is deemed by the Administrator to be its equivalent, in the construction, inspection, maintenance, or repair of aircraft and aircraft appliances.

24.202 AERONAUTICAL SKILL. Applicant shall satisfactorily demonstrate by means of written, oral, and practical tests, his ability with respect to the subject matters prescribed in 24.200 above.

AIRCRAFT ENGINE MECHANIC RATING

24.21 AIRCRAFT ENGINE MECHANIC RATING. To be eligible for an aircraft engine mechanic rating, an applicant shall comply with the following requirements:

24.210 AERONAUTICAL KNOWLEDGE. Applicant shall have theoretical and practical knowledge of aircraft power plants, propellers, and their appliances, shall know how properly to inspect, maintain, and repair same, and shall be generally familiar with the provisions of Parts 03**, and 13, and 14, and thoroughly familiar with the provisions of Part 01 dealing with aircraft airworthiness and the provisions of Parts 18 and 24.

**Part 03—AIRPLANE AIRWORTHINESS Normal, Utility, Acrobatic, and Restricted Purpose Categories is a new part to the Civil Air Regulations. It became effective November 13, 1945. As the sub-title implies, it deals with the Airworthiness requirements relating to the smaller aircraft or especially those not designed for commercial transportation of passangers and cargo.*

***Since the two CAR Parts 03 and 04 are similar as far as mechanics are concerned it is probable that most students will find CAR Part 03 sufficiently informative when preparing for CAA examinations. However, for service use as a mechanic it is suggested that the mechanic familiarize himself with both parts.*

24.211 AERONAUTICAL EXPERIENCE. Applicant shall have had at least 1 year of practical experience, or what is deemed by the Administrator to be its equivalent, in the construction, inspection, maintenance, or repair of aircraft engines, propellers, and their appliances.

24.212 AERONAUTICAL SKILL. Applicant shall satisfactorily demonstrate by means of written, oral and practical tests, his ability with respect to the subject matters prescribed in 24.210 above.

24.30 APPLICATION. Application for a mechanic certificate shall be made upon the applicable form prescribed and furnished by the Administrator.

24.36 REEXAMINATION. An applicant for a mechanic certificate or rating who has failed any prescribed practical or theoretical examination or test may apply for reexamination at any time after the expiration of 30 days from the date of such failure; *Provided,* That an applicant who has failed only the examination on the pertinent Civil Air Regulations may apply for reexamination on the Civil Air Regulations after he has received not less than 5 hours instruction on the Civil Air Regulations from a certified ground instructor and presents a statement from such instructor showing the amount of instruction given and stating that he deems the applicant qualified to pass the required examination.

24.40 GENERAL. The examinations and tests prescribed in this Part will be conducted by an authorized representative of the Administrator.

24.41 TIME AND PLACE. All examinations and tests will be held at such times and places as the Administrator or his representative may prescribe.

24.42 INSPECTION. The applicant for a mechanic certificate or rating shall offer full cooperation with respect to any inspection and examination which may be made of such applicant upon proper request by any authorized representative of the Administrator prior or subsequent to the issuance of a mechanic certificate or rating.

24.43 STANDARD OF PERFORMANCE. All practical or theoretical examinations and tests shall be accomplished to the satisfaction of the Administrator, and the passing grade in each subject of examination or test shall be at least 70 percent.

24.54 MECHANIC IDENTIFICATION CARD. No person shall serve as a mechanic in connection with the inspection, maintenance, overhaul, or repair of aircraft, aircraft engines, propellers, or appliances thereof, or as a parachute rigger, after June 15, 1942, unless he has in his possession, in addition to a currently effective mechanic certificate an identification card, satisfactory to the Administrator, containing his fingerprints, his picture, and his signature.

24.56 REPORTS. The holder of a mechanic's certificate shall transmit to the Administrator, annually, during the month of January, a report for all preceding twelve-month period, setting forth the amount and type of his aeronautical experience and such other pertinent data as the Administrator may require."

1. To clarify parts 24.201 and 24.211 above, the only experience that is "deemed equivalent" to the one year's practical experience, is graduation from a Civil Aeronautics Administration approved school holding ratings corresponding to the certificates sought by the mechanic, such graduation being supported by a diploma issued by the said school. Likewise, the applicant's practical experience unless known to the examining inspector should be supported by letters or other reliable records. Instruction, other than at an approved school, covering aeronautical knowledge as set forth in Section 24.200 and 24.210 will be of considerable assistance in acquiring the necessary information to pass the written examination for these ratings.

2. The written examinations in 24.202 and 24.212 above are the multiple choice type in which the questions are stated, several possible answers are given, and the applicant picks the answer which he decides is the only correct answer. The answers are registered on an answer sheet provided by CAA.

3. The subjects covered by the examinations are:

Aircraft Mechanic

120 questions on the following subjects:

1. Rigging and Assembly
2. Wood, Fabric, Covering and Doping
3. Hydraulic System
4. Sheet Metal and Welding

Aircraft Engine Mechanic

150 questions on the following subjects:

1. Carburetors and Carburetion
2. Magnetos and Ignition System
3. Theory and Maintenance of Power Plants
4. Lubrication and Oiling Systems
5. Propellers

The Civil Air Regulations are not treated as a separate subject in the examinations for mechanics but are dispersed throughout the entire examinations and deal with the specific subject involved.

4. The practical tests in 24.202 and 24.212 above will be given by the Inspector at places and with facilities satisfactory to him and provided by the applicant.

5. Experience as an aircraft or engine mechanic gained in the military service and coming within the scope of Part 24 is applicable on the one year required for applying for the aircraft or aircraft engine mechanic certificate.

6. An applicant, to determine his eligibility for the examination should contact his local Civil Aeronautics Inspector and make available to him all information, records and documents substantiating his training and experience. The Inspector will advise the applicant as to his eligibility for the examination.

7. The name and address of the nearest Inspector may be obtained from the list of Civil Aeronautics Administration District Offices listed in the Appendix Section of this manual. A list of the Regional Offices and addresses is given at the end of this introduction.

8. Aircraft and aircraft engine mechanic examinations are conducted only by official Civil Aeronautics Administration representatives in the United States, Alaska, and Honolulu. Applicants can choose the C.A.A. office most convenient to serve in from the list of Regional C.A.A. Offices or the list of General Inspection District Offices supplied in this publication.

9. Under existing Civil Air Regulations, mechanic certificates that were in effect December 7, 1941, or any certificate issued after that date, do not expire. It is required, however, that a report of activities be submitted for each twelve-month period to the Department of Commerce, Civil Aeronautics Administration, Certificate Section, Washington, D. C.

10. Existing Civil Air Regulations do not provide for any specialist ratings, such as instrument, propeller, radio, electrician, etc., provision being made for the ratings of aircraft and aircraft engine mechanics only.

11. The Regional Offices of the Civil Aeronautics Administration are located as follows:

REGION NO. 1
Civil Aeronautics Administration
385 Madison Avenue, Telephone Plaza 5-5662
New York 17, New York

REGION NO. 2
Civil Aeronautics Administration
84 Marietta Street, N. W., Telephone Walnut 5200
Atlanta 3, Georgia

REGION NO. 3
Civil Aeronautics Administration
608 South Dearborn Street, Telephone Wabash 4275
Chicago 5, Illinois

REGION NO. 4
Civil Aeronautics Administration
P. O. Box 1689, Telephone 6-2141
Fort Worth 1, Texas

REGION NO. 6
Civil Aeronautics Administration
1500 Fourth Street, Telephone 4-3711
Santa Monica, California

REGION NO. 7
Civil Aeronautics Administration
P. O. Box 3224, Telephone Main 4121
Seattle 14, Washington

REGION NO. 8
Civil Aeronautics Administration
P. O. Box 440, Telephone Main 494
Anchorage, Alaska

REGION NO. 9
Civil Aeronautics Administration
P. O. Box 4009
Honolulu 12, T. H.

REGION NO. 5
Civil Aeronautics Administration
Ninth Floor, City Hall Building, Telephone Harrison 0110
Kansas City 6, Missouri

SUGGESTED REFERENCE MATERIAL

The following Government Publications will be of use to the Aircraft Mechanic and to the Aircraft Engine Mechanic.

War Department Technical Manuals (T.M.)

TM 1-400, Theory of Flight.
TM 1-405, Aircraft Engines.
TM 1-406, Aircraft Electrical Systems.
TM 1-407, Aircraft Induction, Fuel and Oil Systems.
TM 1-408, Aircraft Power Plant Operation.
TM 1-410, Airplane Structures.
TM 1-411, Airplane Hydraulic Systems and Misc. Equipment.
TM 1-412, Aircraft Propellers.
TM 1-413, Aircraft Instruments.
TM 1-415, Airplane Inspection Guide.
TM 1-423, Heat Treating and Inspection of Metals.
TM 1-424, Aircraft Hardware and Materials.
TM 1-430, Welding.
TM 1-435, Aircraft Sheet Metal Work.
TM 1-440, Parachutes, Aircraft Fabrics and Clothing.
TM 1-445, Electrical Fundamentals.
TM 1-470, Aircraft Radio Shop Practice.

CIVIL AERONAUTICS BULLETINS (CAB)

CAB 27, Pilots' Airplane Manual.
CAB 28, Pilots' Powerplant Manual.

CIVIL AIR REGULATIONS

CAR Part 01—Airworthiness Certificates
Part 02—Type and Production Certificates
Part 03—Airplane Airworthiness Normal, Utility, Acrobatic and Restricted Purpose Categories
Part 04—Airplane Airworthiness Transport Categories
Part 13—Aircraft Engine Airworthiness
Part 14—Aircraft Propeller Airworthiness
Part 15—Aircraft Equipment Airworthiness
Part 18—Maintenance, Repair and Alteration of Certified Aircraft and of Aircraft Engines, Propellers and Instruments.
Part 24—Mechanic Certificate
Part 43—General Operation Rules
Part 98—Definitions
Part 501—Aircraft Registration Certificates
Part 503—Recordation of Aircraft Ownership

Part 03—AIRPLANE AIRWORTHINESS Normal, Utility, Acrobatic, and Restricted Purpose Categories is a new part to the Civil Air Regulations. It became effective November 13, 1945. As the sub-title implies, it deals with the Airworthiness requirements relating to the smaller *aircraft* or especially those *not designed for commercial transportation of passengers and cargo.*

Part 04—AIRPLANE AIRWORTHINESS Transport Categories. This is the old CAR Part 04 completely revised and which became effective November 9, 1945. The revised part 04 deals specifically with the larger *aircraft* or these *designed strictly for commercial transportation of passengers and cargo.*

The new CAR Part 43—General Operation Rules is of general value to mechanics but section 43.2 deals specifically with maintenance and should be studied by the mechanic.

Complete detailed information on Civil Air Regulations for Mechanics can be found in AERO PUBLISHERS' publication "CIVIL AIR REGULATIONS FOR A. and E. MECHANICS."

CIVIL AERONAUTICS MANUALS (CAM)

CAM 02—Production Certificates.
CAM 03—Airplane Airworthiness, Normal, Utility, Acrobatic and Restricted Purpose Categories.
CAM 04—Airplane Airworthiness, Transport Categories.
CAM 14—Aircraft Propeller Airworthiness.
CAM 15—Aircraft Equipment Airworthiness.
CAM 18—Maintenance, Repair and Alteration of Certified Aircraft and of Aircraft Engines, Propellers and Instruments.

New CAA manuals 03 and 04 related to the new CAR Part 03 AIRPLANE AIRWORTHINESS Normal, Utility, Acrobatic, and Restricted Purpose Categories, and the revised CAR Part 04 AIRPLANE AIRWORTHINESS Transport Categories will no doubt be issued and made available by the Civil Aeronautics Administration at some time in the near future.

CIVIL AIR REGULATIONS

PART 01
AIRWORTHINESS CERTIFICATES

As Amended to October 15, 1942

CIVIL
AERONAUTICS BOARD

WASHINGTON, D. C.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. - - - Price 5 cents

01.1 Airworthiness Certificates.
- 01.10 Application.
- 01.11 Requirements for issuance.
- 01.12 Aircraft Operation Record requirements.
- 01.13 Duration.
- 01.14 Transferability.

01.2 Airworthiness Certificate Rules.
- 01.20 Display.
- 01.21 Cancellation.
- 01.22 Surrender.

01.2 Airworthiness Certificate Rules—Continued.
- 01.23 Inspection.
- 01.24 Maintenance of certificated aircraft.
- 01.25 Periodic inspection.
- 01.26 Other inspections.
- 01.27 Log-books.

01.3 Accidents.
- 01.30 Report and notification of accidents.
- 01.31 Removal, release, and preservation of wreckage.
- 01.32 (Unassigned).
- 01.33 Aircraft accidents.

01.1 AIRWORTHINESS CERTIFICATES

01.10 Application. Application for an airworthiness certificate may be made by the registered owner of any aircraft registered as an aircraft of the United States upon the applicable form prescribed and furnished by the Administrator.

01.11 Requirements for issuance. Prior to the issuance of an airworthiness certificate the subject aircraft shall be inspected by a duly authorized representative for the Administrator to determine whether it is in condition for safe operation and complies with the airworthiness requirements specified in the Civil Air Regulations: *Provided,* That an airworthiness certificate may be issued for an aircraft for which no such certificate has previously been issued and which has been manufactured under type certificate or under a type and a production certificate if the applicant for such certificate, upon request, presents to a duly authorized representative for the Administrator a Statement of Conformity properly executed by the manufacturer of the aircraft on a form prescribed and furnished by the Administrator, and if the aircraft satisfactorily passes an inspection made to determine whether such aircraft is in condition for safe operation: *Provided further,* That an aircraft manufactured under a type certificate only shall undergo, and an aircraft manufactured under a type and a production certificate may be required to undergo, an inspection to determine whether such aircraft conforms to the type certificate under which it is manufactured.

01.12 Aircraft Operation Record requirements. An aircraft for which an airworthiness certificate is currently in effect, hereinafter referred to in these regulations as a certificated aircraft, shall not be operated unless there is attached to such airworthiness certificate the appropriate Aircraft Operation Record prescribed and issued by the Administrator, nor shall such aircraft be operated other than in accordance with the limitations for safe operations prescribed and set forth by the Administrator in such record. An aircraft for which an airworthiness or experimental certificate is in effect on the effective date of this section may be operated without an Aircraft Operation Record until expiration, cancellation, or revocation of any such certificate.

01.13 Duration. An airworthiness certificate shall be of 60 days' duration and, unless the holder thereof is otherwise notified by the Administrator within such period, shall continue in effect indefinitely thereafter, unless suspended, revoked, or cancelled, except that it shall immediately expire (1) at the end of a specifically designated period* after the date of issuance of the certificate or after the date of the last endorsement thereof, whichever is later, if the holder of

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A statement of duration in substantially the form of §01.13 will appear on all airworthiness certificates. The above reference to a "specifically designated period" means the period which will be designated on each airworthiness certificate. Under ordinary circumstances an airworthiness certificate will have to be endorsed each year.

such certificate fails to secure within such period an examination or inspection by an authorized inspector for the Administrator, or (2) at any time an authorized inspector of the Administrator shall refuse to endorse such certificate after examination or inspection.

01.14 Transferability. An airworthiness certificate and the attached currently effective Aircraft Operation Record, upon transfer of ownership, shall remain with the aircraft for which they were issued.

01.2 AIRWORTHINESS CERTIFICATE RULES

01.20 Display. An airworthiness certificate shall be carried at all times in the aircraft for which such certificate has been issued, and shall be presented upon the request of any duly authorized representative for the Administrator or Board, or any State or municipal official charged with enforcing local laws or regulations involving Federal compliance.

01.21 Cancellation. An airworthiness certificate may be cancelled upon the written request of the registered owner of the aircraft.

01.22 Surrender. Upon the cancellation, suspension, revocation, or expiration of an aircraft airworthiness certificate the owner of the aircraft shall, upon request, surrender such certificate to any officer or employee of the Administrator.

01.23 Inspection. An inspector of the Administrator shall be permitted at any time and place to make such inspections as may be deemed necessary to determine compliance with the requirements of this Part of the Civil Air Regulations.

01.24 Maintenance of certificated aircraft. A certificated aircraft shall not be operated unless maintained in condition for safe operation.

01.25 Periodic inspection. A certificated aircraft shall not be operated unless, within the 100 hours of flight time last preceding such operation such aircraft shall have been given a periodic inspection. Such inspection shall be made by a person to whom there has been issued a currently effective and appropriate mechanic certificate, and shall be made in accordance with the Periodic Aircraft Inspection Report form prescribed and furnished by the Administrator: *Provided*, That in the case of aircraft operated in scheduled air transportation service, such inspection shall be made in accordance with a form acceptable to the Administrator. The results of such inspection shall be entered in the aircraft log-book and on the Periodic Aircraft Inspection Report form over the signature and certificate number of the person making the same.

01.26 Other inspections. In all cases, except inspections following repairs or alterations to certificated aircraft, the registered owner shall be responsible for having such aircraft given a periodic inspection, by a person to whom there has been issued a currently effective and appropriate mechanic certificate, within a reasonable time prior to presentation for inspection by a duly authorized representative of the Administrator. In cases of inspections following repairs or alterations of aircraft, such representative may require such inspection of the aircraft as he deems necessary, by a person to whom there has been issued a currently effective and appropriate mechanic certificate.

01.27 Log-books. The registered owner of a certificated aircraft shall be responsible for the maintenance and, upon request, the presentation to a duly authorized representative of the Administrator or Board, of a log-book for the aircraft and a log-book for each engine installed therein. Such log-books shall be current, accurate, legible, and permanent records. The aircraft log-book shall contain an operating history of the aircraft which shall include, but shall not be limited to, flight time of the aircraft, reports of periodic or other inspections, minor repairs, and minor alterations of the aircraft structure and propellers. Each engine log-book shall contain an operating history of the aircraft engine to which it pertains, which shall include, but shall not be limited to, the running time of the engine in flight, reports of inspections, minor repairs, and minor alterations of the aircraft engine. Log-book entries may be replaced in the case of scheduled air carrier aircraft, aircraft engines, and propellers, by a suitable system of recording the information required in this section.

01.270 Log-books for rebuilt aircraft engines. A new aircraft engine log-book may be used for an aircraft engine rebuilt by the manufacturer. Such log-book shall contain a signed statement, by such manufacturer or his authorized representative, setting forth the date the engine was rebuilt and such other information as the Administrator may deem necessary. Such log-book shall be maintained in acccrdance with section 01.27, except that the operating history of the engine prior to the date it was rebuilt shall not be required.

01.3 ACCIDENTS

01.30 Report and notification of accidents. A written report shall be made without delay to the Civil Aeronautics Board at its nearest branch office of every accident involving a civil aircraft which occurs within the United States* and every accident involving a certificated aircraft of the United States, without regard to where it occurs. Such report shall be made upon an accident report form furnished by the Civil Aeronautics Board. In addition, the Civil Aeronautics Board, or the Administrator of Civil Aeronautics, shall be notified immediately in person or by cable, telegraph, telephone, or radio, of the occurrence of any air carrier accident, or accident resulting in serious or fatal injury to any person, or accident known or believed to have resulted from a structural failure in flight. This requirement of immediate notification shall apply to every such accident involving civil aircraft which occurs within the United States and every such accident involving air carrier aircraft without regard to where it occurs. The pilot in command of a non-air carrier aircraft involved in the accident shall make the report and notification of the accident as required by this section unless he is incapacitated, in which event the operator** of the aircraft shall make such report and notification. The operator of an air carrier aircraft involved in an accident shall make such report and notification.

01.31 Removal, release, and preservation of wreckage.

01.310 Removal. (a) No aircraft or part thereof, involved in an air carrier accident or in an accident resulting in serious or fatal injury to any person, or accident known or believed to have resulted from structural failure in flight, shall be moved or disturbed, except:

(1) When necessary for giving assistance to persons injured or trapped in the wreckage;

(2) When necessary in the interest of public safety;

(3) When specific permission shall have been granted by an authorized representative of the Civil Aeronautics Board, or of the Administrator of Civil Aeronautics;

(4) When prompt movement of the aircraft is necessary to protect it from further serious damage and it is impossible to secure immediate communication with any person authorized in subsection (3) to direct the removal.

(b) Any movement of the aircraft, or any part thereof, under subsection (a) shall be so accomplished as to entail the minimum possible disturbance of the material concerned. Prior to such movement a record of the original position and condition of the wreckage (as complete and accurate as possible under the circumstances) shall be made unless the danger to public safety is such as to permit of no delay whatever, or unless an authorized representative of the Civil Aeronautics Board has directed otherwise.

(c) The requirements of this section shall be applicable with respect to all accidents an described in subsection (a) hereof, which occur within the United States and with respect to all air carrier accidents without regard to where they occur.

01.311 Release. No aircraft or part thereof, involved in an air carrier accident or in an accident resulting in serious or fatal injury to any person, or accident known or believed to have resulted from structural failure in flight, shall be released for repair, salvage, disposal, or any other purpose except upon specific permission granted by an authorized representative of the Civil Aeronautics Board.

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*"United States," as used in these regulations, means the States, the Territories and possessions, and the territorial waters surrounding them unless a different meaning is specifically indicated.

**"Operator," includes the owner or lessee or any other person that causes or authorizes the operation of the aircraft.

01.312 Preservation. An aircraft, aircraft engine, propeller or appliance, or any part or parts thereof, involved in an accident, shall be preserved and removed to such place or places as directed by the Civil Aeronautics Board or any authorized representative thereof for purposes of safekeeping, inspection, testing, or any other purpose consistent with the powers and duties granted the Civil Aeronautics Board under section 702 (a) of the Civil Aeronautics Act of 1938, as amended: *Except*, That the wreckage of an aircraft involved in a type of accident other than the categories described in § 01.310 need not be preserved unless specifically directed by the Civil Aeronautics Board or an authorized representative thereof.

01.32 (Unassigned).

01.33 Aircraft accidents. An accident involving aircraft is an occurrence involving either or both of the following conditions: (a) an accident which results in serious injury or death to an occupant of an aircraft, or to any other person by direct contact with the aircraft; (b) an accident which results in damage to an aircraft sufficiently serious to render it unairworthy. Defects or damage first discovered during routine maintenance, inspection, or overhaul shall not be considered as constituting damage under this definition regardless of its nature or extent.

CIVIL AIR REGULATIONS

PART 02.—TYPE AND PRODUCTION CERTIFICATES

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02.1 Type certificates.

02.10 Application. Application for a type certificate for an aircraft, aircraft engine, propeller, or for any appliance specified in the Civil Air Regulations as eligible for such certificate, shall be made upon the applicable form prescribed and furnished by the Administrator.

02.11 Requirements for issuance. The applicant shall submit, with the application or within a reasonable time thereafter, technical data, including drawings, representing the design, material, specifications, construction, and performance of the aircraft, aircraft engine, propeller, or appliance, and during manufacture and after completion, such aircraft, aircraft engine, propeller, or appliance shall be subjected to specified tests and shall successfully meet specified standards. The foregoing shall be successfully accomplished in such manner and form as may be required by the Civil Air Regulations.

02.12 Duration. A type certificate shall be of indefinite duration, unless cancelled, suspended, or revoked.

02.13 Transferability and licensing. A type certificate is transferable, and the benefits of such certificate may be extended by licensing arrangements. In the event of any transfer or licensing arrangement, the person making the transfer or granting the license shall immediately notify the Administrator in writing. Upon the termination of any licensing arrangement, the person holding the license shall immediately notify the Administrator in writing.

02.2 Production certificates.

02.20 Application. Application for a production certificate for an aircraft, aircraft engine, propeller, or for any appliance specified in the Civil Air Regulations as eligible for such certificate, shall be made upon the applicable form prescribed and furnished by the Administrator.

02.21 Requirements for issuance. The applicant shall hold a currently effective type certificate for the type of aircraft, aircraft engine, propeller, or appliance proposed to be manufactured or shall hold a current right to the benefits of such type certificate under a licensing arrangement. The applicant shall also demonstrate, to the satisfaction of the Administrator, that he is adequately prepared to produce duplicates of the aircraft, aircraft engine, propeller, or appliance for which such type certificate has been issued.

02.22 **Production Limitation Record.** The benefits of a production certificate shall be available only with respect to the type certificate or certificates set forth in the currently effective Production Limitation Record,[1] prescribed and issued by the Administrator, which shall be attached to the production certificate.

02.23 **Duration.** A production certificate shall be of 60 days' duration and, unless the holder thereof is otherwise notified by the Administrator within such period, shall continue in effect indefinitely thereafter, unless cancelled, suspended, or revoked.

02.24 **Transferability.** A production certificate shall not be transferred.

02.3 Type and production certificate rules.

02.30 **Display.** Type and production certificates shall be presented upon the request of any duly authorized representative of the Administrator, or any State or municipal official charged with enforcing local laws or regulations involving Federal compliance.

02.31 **Cancellation.** Type and production certificates may be cancelled upon the written request of the holder thereof.

02.32 **Surrender.** Upon the cancellation, suspension, revocation, or expiration of a type or production certificate, the holder thereof shall, upon request, surrender such certificate to any officer or employee of the Administrator.

02.33 **Inspection.** An inspector of the Administrator shall be permitted at any time and place to make such inspections as may be deemed necessary to determine compliance with the requirements of this Part of the Civil Air Regulations.

02.34 **Statement of Conformity.** The holder of a type certificate or of a current right to the benefits of a type certificate under a licensing arrangement, upon the transfer by him of the ownership of any aircraft manufactured under such type certificate, shall, unless an airworthiness certificate has previously been issued, furnish to the transferee of such aircraft a Statement of Conformity on a form prescribed and furnished by the Administrator.

02.35 **Production reports.** On the first day of January and July of each year and at such other times as the Administrator may require, every holder of a type certificate, of a production certificate, or of a current right to the benefits of a type certificate under a licensing arrangement, shall transmit to the Administrator a correct and completely executed production report on the form prescribed and furnished by the Administrator. Such reports shall be transmitted regardless of whether any aircraft, aircraft engines, propellers, or appliances were constructed during the period covered by the report.

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[1] This Record will contain a list of the type certificates with respect to which the production certificate is applicable. It supplants the "letter of transmittal" heretofore issued.

SECTION THREE

CIVIL AIR REGULATIONS

PART 03

The new Civil Air Regulations Part 03, AIRPLANE AIRWORTHINESS, Normal, Utility, Acrobatics and Restricted Purpose Categories and the revised Civil Air Regulations Part 04, AIRPLANE AIRWORTHINESS, Transport Categories are similar except, as the sub-title indicates, in the application to the operational use of the aircraft involved.

Since the new Part 03 deals with aircraft with which the beginning mechanic will be mostly concerned, the portions most important to mechanics are reproduced herein.

Since the revised Part 04 gives no great amount of information to the beginner in addition to the new Part 03, it is not reproduced in this manual. In order to indicate the similarity of the two parts, the Table of Contents of Part 04, AIRPLANE AIRWORTHINESS, Transport Categories, is reproduced on Page 56.

Part 03 and Part 04 each deal principally with airworthiness and therefore much engineering reference material is included and as such is not of great importance to mechanics. The excerpts used are those of particular value to mechanics.

CIVIL AERONAUTICS BOARD

WASHINGTON, D. C.

PART 03

CIVIL AIR REGULATIONS AMENDMENT 03-0
Effective: November 13, 1945

AIRPLANE AIRWORTHINESS

NORMAL, UTILITY, ACROBATIC, AND RESTRICTED PURPOSE CATEGORIES

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03.0 Scope. An airplane shall be shown to comply with the airworthiness requirements set forth in this Part and shall have no characteristic which, according to the findings of the Administrator, makes the airplane unairworthy in order to become eligible for type and airworthiness certificates, provided that,

(a) If any of these requirements become inapplicable to a particular airplane because of increased knowledge of aeronautics or of the development of unforseen design features, the Administrator shall accept designs shown to provide an equivalent standard of safety.

(b) Other requirements with respect to airworthiness found by the Administrator to provide an equivalent standard of safety shall be accepted in lieu of the requirements set forth in this Part.

03.00 Date of effectiveness. Airplanes certificated as a type on or after November 13, 1945, shall comply either with (1) the entire provisions of Part 04 of the CAR in effect immediately prior to November 9, 1945, or (2) the entire provisions prescribed herein except that airplanes certificated under (1) may incorporate provisions of (2) when the Administrator finds the standard of safety to be equivalent to the particular and all related items of the latter.

Airplanes certificated as a type on or after January 1, 1947, shall comply with the provisions contained herein. If the prototype is not flown prior to January 1, 1947, and satisfactory evidence is presented indicating that the design work of the type was well advanced prior to November 13, 1945, and the delay of completion of the airplane was due to causes beyond the manufacturer's control, the Administrator may certificate the airplane as a type under the provisions of Part 04 which were in effect prior to November 9, 1945.

Unless otherwise specified, compliance with an amendment to this Part shall be mandatory only for airplanes for which application for a type certificate has been received subsequent to the effective date of such amendment.

03.01 Airplane categories. In this Part airplanes are divided upon the basis of their intended operation into the following categories for the purposes of certification:

Normal	Suffix "N"

Airplanes in this category are intended for non-acrobatic, non-scheduled passenger, and non-scheduled cargo operation.

Utility	Suffix "U"

Airplanes in this category are intended for normal operations and limited acrobatic maneuvers. These airplanes are not suited for use in snap or inverted maneuvers.

Acrobatic Suffix "A"

Airplanes in this category will have no specific restrictions as to type of maneuver permitted unless the necessity therefor is disclosed by the required flight tests.

Restricted Purpose Suffix "R"

Airplanes in this category are intended to be operated for restricted purposes not logically encompassed by the foregoing categories. The requirements of this category shall consist of all of the provisions for any one of the foregoing categories which are not rendered inapplicable by the nature of the special purpose involved, plus suitable operating restrictions which the Administrator finds will provide a level of safety equivalent to that contemplated for the foregoing categories.

An airplane may be certificated under the requirements of a particular category, or in more than one category, provided that all of the requirements of such categories are met. Sections of this Part which apply to only one or more, but not all, categories are identified in this Part by the appropriate suffixes as indicated above, added to the section number. All sections not identified by a suffix are applicable to all categories except as otherwise specified.

03.02 Airworthiness certificates. Airworthiness certificates are classified as follows:

(a) NC certificates. In order to become eligible for an NC certificate, an airplane must be shown to comply with all of the requirements contained in this Part for at least one category, but not the restricted purpose category.

(b) NR certificates. In order to become eligible for an NR certificate, an airplane must be shown to comply with all of the requirements of the restricted purpose category.

(c) NX certificates. An airplane will become eligible for an NX certificate when the applicant presents satisfactory evidence that the airplane is to be flown for experimental purposes and the Administrator finds it may, with appropriate restrictions, be operated for that purpose in a manner which does not endanger the general public. Airplanes used in racing and exhibition flying may be issued NX certificates under the terms of this section. The applicant shall submit sufficient data such as photographs to identify the airplane satisfactorily and, upon inspection of the airplane, any pertinent information found necessary by the Administrator to safeguard the general public.

An airplane manufactured in accordance with a type certificate (See 03.03) and conforming with the type design will become eligible for an airworthiness certificate when, upon inspection of the airplane, the Administrator determines it so to conform and that the airplane is in a condition for safe operation. For each newly manufactured airplane this determination shall include a flight check by the applicant.

03.03 Type certificates. A type certificate will be issued when the following requirements are met:

03.031 Data required for NC and NR certification. The applicant for a type certificate shall submit to the Administrator the following:

Such descriptive data, test reports, and computations as are necessary to demonstrate that the airplane complies with the airworthiness requirements. The descriptive data shall be known as the type design and shall consist of drawings and specifications disclosing the configuration of the airplane and all design features covered in the airworthiness requirements as well as sufficient information on dimensions, materials, and processes to define the strength of the structure. The type design shall describe the airplane in sufficient detail to permit the airworthiness of subsequent airplanes of the same type to be determined by comparison with the type design.

03.032 Inspection and tests for NC and NR certification. The authorized representatives of the Administrator shall have access to the airplane and may witness or conduct such inspections and tests as are necessary to determine compliance with the airworthiness requirements.

03.0320 Inspection. Inspections and tests shall include all those found necessary by the Administrator to insure that the airplane conforms with the following:

(a) All materials and products are in accordance with the specification given in the type design.

(b) All parts of the airplane are constructed in accordance with the drawings contained in the type design.

(c) All manufacturing processes, construction, and assembly are such that the design strength and safety contemplated by the type design will be realized in service.

03.0321 Flight tests. Upon satisfactory completion of all necessary inspection and testing on the ground, and upon receipt from the applicant of a report of flight tests conducted by him, and satisfactory proof of the conformity of the airplane with the type design, such official flight tests as the Administrator finds necessary to prove compliance with this Part shall be conducted.

03.04 Changes. Changes shall be substantiated to demonstrate compliance of the airplane with the appropriate airworthiness requirements in effect when the particular airplane was certificated as a type unless the applicant chooses to show compliance with the currently effective requirements subject to the approval of the Administrator, or unless the Administrator finds it necessary to require compliance with current airworthiness requirements.

03.040 Minor changes. Minor changes to certificated airplanes which obviously do not impair the condition of the airplane for safe operation shall be approved by the authorized representatives of the Administrator prior to the submittal to the Administrator of any required revised drawings.

03.041 Major changes. A major change is any change not covered by minor changes as defined in 03.040, Minor changes.

03.042 Service experience changes. When the Administrator finds that service experience indicates the need for design changes, the applicant shall submit for the approval of the Administrator engineering data describing and substantiating the necessary changes. The Administrator may in such cases withhold issuance of airworthiness certificates for additional airplanes of the type involved until satisfactory corrective measures have been taken. Upon approval by the Administrator, these changes shall be considered as a part of the type design, and descriptive data covering these changes shall be furnished by the applicant to all aircraft owners concerned.

03.0420 In the case of airplanes approved as a type under the terms of earlier airworthiness requirements, the Administrator may require that an airplane submitted for an original airworthiness certificate comply with such portions of the currently effective airworthiness requirements as may be necessary for safety.

03.07 Definitions.

03.070 General.

03.0701 Standard atmosphere. The standard atmosphere shall be based upon the following assumptions:

(a) The air is a dry perfect gas.
(b) The temperature at sea level is 59°F.
(c) The pressure at sea level is 29.92 inches Hg.
(d) The temperature gradient from sea level to the altitute at which the temperature becomes -67°F is -0.003566°F/Ft. and zero thereabove.
(e) The density, o, at sea level under the above conditions is 0.002378 lbs. Sec.^{2}/Ft.^{4}.

03.0702 Hot day condition. See 03.4400.

03.0703 Airplane configuration. This term refers to the position of the various elements affecting the aerodynamic characteristics of the airplane, such as landing gear, flaps, etc.

03.071 Weights.

	Reference Sections
Empty weight. The actual weight used as a basis for determining operating weights.	03.112
Maximum weight. The maximum weight at which the airplane may operate in accordance with the airworthiness requirements.	03.113
Minimum weight. The minimum weight at which compliance with the airworthiness requirements is demonstrated.	03.114
Maximum design weight. The maximum weight used for the structural design of the airplane.	03.210
Minimum design weight. The minimum weight condition investigated in the structural flight load conditions, not greater than the minimum weight specified in 03.114, Minimum Weight.	03.210
Design landing weight. The weight used in the structural investigation of the airplane for normal landing conditions. Under the provisions of 03.240, this weight may be equal to or less than the maximum design weight.	03.240

Unit weights for design purposes.

Gasoline	6 lbs. per U.S. gallon
Lubricating oil	7.5 lbs. per U.S. gallon
Crew and Passengers	170 lbs. per person

03.072 Power.

One horsepower 33,000 ft. lbs. per minute

Take-off power. The take-off rating of the engine established in accordance with Part 13, "Aircraft Engine Airworthiness."

Maximum continuous power. The maximum continuous rating of the engine established in accordance with Part 13, "Aircraft Engine Airworthiness."

03.073 Speeds.

Reference Sections

V_t True airspeed of the airplane relative to the undisturbed air.

In the following symbols having subscripts, V denotes:

(a) "Equivalent" airspeed for structural design purposes equal to V_t

(b) "True indicated" or "calibrated" airspeed for performance and operating purposes equal to indicator reading corrected for position and instrument errors.

		Reference Sections
V_{s_o}	stalling speed, in the landing configuration	03.121
V_{s1}	stalling speed in the configurations specified for particular conditions	03.121
V_x	speed for best angle of climb	
V_y	speed for best rate of climb	
V_{mc}	minimum control speed	03.1312
V_{s_f}	computed stalling speed at design landing weight with flaps fully deflected	03.212
V_f	design speed for flight load conditions with flaps in landing position	03.212
V_p	design maneuvering speed	03.2110
V_c	design dive speed	03.2110
V_{ne}	never exceed speed	03.6001
Maximum structural cruising speed.		03.6002

03.074 Structural terms.

Structure. Those portions of the airplane the failure of which would serious endanger the safety of the airplane.

Design wing area, S. The area enclosed by the wing outline (including ailerons, and flaps in the retracted position, but ignoring fillets and fairings) on a surface containing the wing chords. The outline is assumed to extend through the nacelles and fuselage to the plane of symmetry.

Aerodynamic coefficients, C_L, C_N, C_M, etc., used herein, are non-dimensional coefficients for the forces and moments acting on an airfoil, and correspond to those adopted by the U.S. National Advisory Committee for Aeronautics.

C_L = airfoil lift coefficient

C_N = airfoil normal force coefficient (normal to wing chord line)

C_{NA} = airplane normal force coefficient (based on lift of complete airplane and design wing area)

C_M = pitching moment coefficient

	Reference Sections
Loads.	
Limit load. The maximum load anticipated in service.	03.200
Ultimate load. The maximum load which a part of structure must be capable of supporting.	03.202
Factor of Safety. The factor by which the limit load must be multiplied to establish the ultimate load.	03.201
Load factor or acceleration factor, n The ratio of the force acting on a mass to the weight of the mass. When the force in question represents the net external load acting on the airplane in a given direction, n represents the acceleration in that direction in terms of the gravitational constant.	
Limit load factor. The load factor corresponding to limit load.	
Ultimate load factor. The load factor corresponding to ultimate load.	

03.3 DESIGN AND CONSTRUCTION

03.30 General. The airplane shall not incorporate design features or details which experience has shown to be hazardous or unreliable. The suitability of all questionable design details or parts having an important bearing on safety in operation shall be established by tests. Minimum tests required to prove the strength and proper functioning of particular parts are specified.

03.300 Approved specifications and parts. Where the word "approved" or "acceptable" is used in this Part to describe specifications, materials, parts, methods, and processes, such items shall be specifically approved by the Administrator upon a basis and in a manner found by him to be necessary to safety.

03.301 Materials. The suitability and durability of all materials used in the airplane structure shall be established on the basis of experience or tests. All materials used in the airplane structure shall conform to approved specifications which will insure their having the strength and other properties assumed in the design data.

03.302 Fabrication methods. The methods of fabrication employed in constructing the airplane structure shall be such as to produce a uniformly sound structure. When a fabrication process such as gluing, spot-welding, or heat-treating requires close control to attain this objective, the process shall be performed in accordance with an approved process specification.

03.3020 Standard fastenings. All bolts, pins, screws, and rivets used in the structure shall be of an approved type. The use of an approved locking device or method is required for all such bolts, pins, and screws. Self-locking nuts shall not be used on bolts subject to rotation in operating the airplane.

03.303 Protection. All members of the structure shall be suitably protected against deterioration or loss of strength in service due to weathering, corrosion, abrasion, or other causes. In seaplanes, special precaution shall be taken against corrosion from salt water, particularly where parts made from different metals are in close proximity. Adequate provisions for ventilation and drainage shall be made.

03.304 Inspection provisions. Adequate means shall be provided to permit the close examination of such parts of the airplane as require periodic inspection, adjustments for proper alignment and functioning, and lubrication of moving parts.

03.331 External bracing.

03.332 Covering. Strength tests of fabric covering are required unless approved grades of cloth, methods of support, attachment, and finishing are employed. Special tests may be required when it appears necessary to account for the effects of unusually high design airspeeds, slipstream velocities, or other unusual conditions.

03.34 Control surfaces (fixed and movable).

03.342 Installation. Movable tail surfaces shall be so installed that there is no interference between the surfaces or their bracing when each is held in its extreme position and all others are operated through their full angular movement. When an adjustable stabilizer is used, stops shall be provided which will limit its travel, in the event of failure of the adjusting mechanism, to a range equal to the maximum required to trim the airplane in accordance with § 03.132.

03.343 Hinges. Control surface hinges, excepting ball and roller bearings, shall incorporate a multiplying factor of safety of not less than 6.67 with respect to the ultimate bearing strength of the softest material used as a bearing. For hinges incorporating ball or roller bearings, the approved rating of the bearing shall not be exceeded. Hinges shall provide sufficient strength and rigidity for loads parallel to the hinge line.

03.35 Control systems.

03.350 General. All controls shall operate with sufficient ease, smoothness, and positiveness to permit the proper performance of their function and shall be so arranged and identified as to provide satisfactory convenience in operation and prevent the possibility of confusion and subsequent inadvertent operation. (See § 03.3802 for cockpit controls.)

03.351 Primary flight controls. Primary flight controls are defined as those used by the pilot for the immediate control of the pitching, rolling, and yawing of the airplane.

For two-control airplanes the design shall be such as to minimize the likelihood of complete loss of the lateral-directional control in the event of failure of any connecting or transmitting element in the control system.

03.352 Trimming controls. Proper precautions shall be taken against the possibility of inadvertent, improper, or abrupt tab operations. Means shall be provided adjacent to the control to indicate to the pilot the direction of control movement relative to airplane motion and the position of the trim device with respect to the range of adjustment. Trimming devices shall be capable of continued normal operation in spite of the failure of any one connecting or transmitting element in the primary flight control system. Tab controls shall be irreversible unless the tab is properly balanced and investigated for flutter. Irreversible tab systems shall provide adequate rigidity and reliability in the position of the system from the tab to the attachment of the irreversible unit to the airplane structure.

03.353 Wing flap controls. The controls shall be such that when the flap has been placed in any position upon which compliance with the performance requirements is based, the flap will not move from that position except upon further adjustment of the control. Means shall be provided to indicate the flap position to the pilot. If any flap position other than fully retracted or extended is used to show compliance with the performance requirements, such means shall indicate each such position.

The time required to extend fully or to retract flaps shall not be less than 15 seconds unless it is demonstrated that the operation of the flaps in a lesser time does not result in unsatisfactory flight characteristics. (See § 03.13101 and § 03.13102.)

03.3530 Flap interconnection. The motion of flaps on opposite sides of the plane of symmetry shall be synchronized by a mechanical interconnection unless another means of interconnection is employed and shown to provide equivalent reliability, or the airplane is demonstrated to have safe flight characteristics while the flaps are retracted on one side and extended on the other.

Where an interconnection is used, it shall, in the case of multi-engined airplanes, be designed to account for the unsymmetrical loads resulting from flight with the engines on one side of the plane of symmetry inoperative and the remaining engines at take-off power. For single engined airplanes, it may be assumed that 100% of the critical airload acts on one side and 70% on the other.

03.354 Stops. All control systems shall be provided with stops which positively limit the range of motion of the control surfaces. Stops shall be so located in the system that wear, slackness, or take-up adjustments will not appreciably affect the range of surface travel. Stops shall be capable of withstanding the loads corresponding to the design conditions for the control system.

03.355 Control system locks. When a device is provided for locking a control surface while the airplane is on the ground or water:

(a) The locking device shall be so installed as to provide unmistakeable warning to the pilot when it is engaged.

(b) Means shall be provided to preclude the possibility of the lock becoming engaged during flight.

03.356 Proof of strength. Tests are required to prove compliance with limit load requirements. The direction of test loads shall be such as to produce the most severe loading of the control system structure. The tests shall include all fittings, pulleys, and brackets used to attach the control system to the primary structure. Analyses or individual load tests shall be conducted to demonstrate compliance with the multiplying factor of safety requirements specified for control system joints subjected to angular motion.

03.3560 Operation test. An operation test shall be conducted by operating the controls from the pilot's compartment with the entire system so loaded as to correspond to the limit air loads on the surface. In this test there shall be no jamming, excessive friction, or excessive deflection.

03.357 Control system details.

03.3570 General. All control systems and operating devices shall be so designed and installed as to prevent jamming, chafing, or interference as a result of inadequate clearances or from cargo, passengers, or loose objects. Special precautions shall be provided in the cockpit to prevent the entry of foreign objects into places where they might jam the controls. Provisions shall be made to prevent the slapping of cables or tubes against parts of the airplane.

03.3571 Cable systems. Cables, cable fittings, turnbuckles, splices, and pulleys shall be in accordance with approved specifications. Cables smaller than 1/8-inch diameter shall not be used in primary control systems. The design of cable systems shall be such that there will not be hazardous change in cable tension throughout the range of travel under operating conditions and temperature variations. Pulley types and sizes shall correspond to the cables with which they are used, as specified on the pulley specification. All pulleys shall be provided with satisfactory guards which shall be closely fitted to prevent the cables becoming misplaced, or fouling even when slack. The pulleys shall lie in the plane passing through the cable within such limits that the cable does not rub against the pulley flange. Fairleads shall be so installed that they are not required to cause a change in cable direction of more than 3°. Clevis pins (excluding those not subject to load or motion) retained only by cotter pins shall not be employed in the control system. Turnbuckles shall be attached to parts having angular motion in such a manner as to positively prevent binding throughout the range of travel. Provisions for visual inspection shall be made at all fairleads, pulleys, terminals, and turnbuckles.

03.3572 Joints. Control system joints subjected to angular motion in push-pull systems, excepting ball and roller bearings systems, shall incorporate a multiplying factor of safety of not less than 3.33 with respect to the ultimate bearing strength of the softest material used as a bearing. This factor may be reduced to 2.0 for such joints in cable control systems. For ball or roller bearings the approved rating of the bearing shall not be exceeded.

03.3573 Spring devices. The reliability of any spring devices used in the control system shall be established by tests simulating service conditions unless it is demonstrated that failure of the spring will not cause flutter or unsafe flight characteristics.

03.36 Landing gear.

03.361 Shock absorbers. Main, nose, and tail wheel units shall incorporate shock absorbing elements which shall be substantiated by the tests specified in the following subsection. In addition, the shock absorbing ability of the landing gear in taxiing must be demonstrated in the operational tests of § 03.143.

03.3620 Emergency operation. When other than manual operation of the landing gear is employed, an auxiliary means of extending the landing gear shall be provided.

03.3621 Operation test. Proper functioning of the landing gear retracting mechanism shall be demonstrated by operation tests.

03.3622 Position indicator and warning device. When retractable landing wheels are used, means shall be provided for indicating to the pilot when the wheels are secured in either extreme position. In addition, land-planes shall be provided with an aural warning device or a warning device which the Administrator finds to be equally effective, which shall function continuously after the throttle is closed until the gear is down and locked.

03.3623 Control. (See § 03.3802)

03.364 Tires. A landing gear wheel may be equipped with any make or type of tire, provided that the tire is a proper fit on the rim of the wheel and provided that the approved tire rating is not exceeded under the following conditions:

(a) load on main wheel tires equal to the airplane weight divided by the number of wheels.

(b) load on nose wheel tires (to be compared with the dynamic rating established for such tires) equal to the reaction obtained at the nose wheel, assuming the mass of the airplane concentrated at the center of gravity and exerting a force of 1.0 downward and 0.31g forward, the reactions being distributed to the nose and main wheels by the principle of statics with the drag reaction at the ground applied only at those wheels having brakes. When specially constructed tires are used to support an airplane, the wheels shall be plainly and conspicuously marked to that effect. Such markings shall include the make, size, number of plies, and identification marking of the proper tire.

Approved ratings are those assigned by the Tire and Rim Association or by the Administrator.

03.365 Brakes. Brakes shall be installed which are adequate to prevent the airplane from rolling on a paved runway while applying take-off power to the critical engine, and of sufficient capacity to provide adequate speed control during taxiing without the use of excessive pedal or hand forces.

03.366 Skis. Skis shall be approved in accordance with the ski requirements of Part 15. The approved rating of the skis shall not be less than the maximum weight of the airplane on which they are installed.

03.3660 Installation. When type certificated skis are installed, the installation shall be made in accordance with the ski or airplane manufacturer's recommendations which shall have been approved by the Administrator. When other than type certificated skis are installed, data shall be submitted to the Administrator showing a dimensional drawing of the proposed method of attaching the skis, the sizes and materials of the restraining members, and attachment fittings.

In addition to such shock cord(s) as may be provided, front and rear check cables shall be used on skis not equipped with special stabilizing devices.

03.3661 Tests.

(a) If the airplane is of a model not previously approved with the specific ski installation, it shall satisfactorily pass a ground inspection of the installation, demonstrate satisfactory landing and taxiing characteristics, and comply with such flight tests as may be deemed necessary to indicate that the airplane's flight characteristics are satisfactory with the skis installed.

(b) If the airplane is of a model previously approved with the specific ski installation, it need only satisfactorily pass a ground inspection of the installation.

03.37 Hulls and floats.

03.370 Buoyancy (main seaplane floats). Main seaplane floats shall have a buoyance in excess of that required to support the gross weight of the airplane in fresh water as follows:

(a) 80% in the case of single floats,
(b) 90% in the case of double floats.

Main seaplane floats for use on airplanes of 2,500 lbs. or more maximum authorized weight shall contain at least 5 water-tight compartments of approximately equal volume. Main seaplane floats for use on airplanes of less than 2,500 lbs. maximum authorized weight shall contain at least 4 such compartments.

03.371 Buoyancy (boat seaplanes). The hulls of boat seaplanes and amphibians shall be divided into water-tight compartments in accordance with the following requirements:

(a) In airplanes of 5,000 lbs. or more maximum authorized weight, the compartments shall be so arranged that, with any 2 adjacent compartments flooded, the hull and auxiliary floats (and tires, if used) will retain sufficient buoyancy to support the gross weight of the airplane in fresh water.

(b) In airplanes of 1,500 to 5,000 lbs. or more maximum authorized weight, the compartments shall be so arranged that, with any one compartment flooded, the hull and auxiliary floats (and tires, if used) will retain sufficient buoyancy to support the maximum authorized weight of the airplane in fresh water.

(c) In airplanes of less than 1,500 lbs. maximum authorized weight, water-tight subdivision of the hull is not required.

(d) Bulkheads may have water-tight doors for the purpose of communication between compartments.

03.372 Water stability. Auxiliary floats shall be so arranged that when completely submerged in fresh water, they will provide a righting moment which is at least 1.5 times the upsetting moment caused by the airplane being tilted. A greater degree of stability may be required in the case of large flying boats, depending on the height of the center of gravity above the water level, the area and location of wings and tail surfaces, and other considerations.

03.38 Fuselage.

03.380 Pilot compartment.

03.3800 General. The arrangement of the pilot compartment and its appurtenances shall provide a satisfactory degree of safety and assurance that the pilot will be able to perform all his duties and operate the controls in the correct manner without unreasonable concentration and fatigue.

The primary flight control units listed on Figure 04-14, excluding cables and control rods, shall be so located with respect to the propellers that no portion of the pilot or controls lie in the region between the plane of rotation of any inboard propeller and the surface generated by a line passing through the center of the propeller hub and making an angle of 5° forward or aft of the plane of rotation of the propeller.

03.3801 Vision. The pilot compartment shall be arranged to afford the pilot a sufficiently extensive, clear, and undistorted view for the safe operation of the airplane. There shall be provided a window or portion thereof so arranged that during flight in a moderate rain condition, it can be opened or it will remain or be maintained in a clean condition without continuous attention by the pilot. Under such conditions the pilot shall have an adequate view of the flight path in normal flight and landing, and sufficient protection from the elements that his vision is not impaired. The pilot compartment shall be free of glare and reflections which would interfere with the pilot(s) vision. For airplanes intended for night operation, this shall be demonstrated in night flight tests.

03.38010 Pilot windshield and windows. All glass panes shall be of a non-splintering safety type.

03.3802 Cockpit controls. All cockpit controls shall be so located and, except for the primary controls, identified so as to provide greatest satisfactory convenience in operation including adequate provisions to prevent the possibility of confusion and consequent inadvertent operation. See Figure 03-14 for required sense of motion of cockpit controls. The controls shall be so located and arranged with respect to the pilot's seat that it will be readily possible for the operator to obtain full and unrestricted movement of each control without interference from either the cockpit structure or the operator's clothing when seated.

Identical powerplant controls for the several engines in the case of multi-engine airplanes shall be so located as to prevent any misleading impression as to the engines to which they relate.

03.38021 Instruments and markings. See § 03.5200 relative to instrument arrangement. The operational markings, instructions, and placards required for the instruments, controls, etc., are specified in § 03.610.

COCKPIT CONTROLS

Figure 03-14

Controls	Movement and Actuation
Primary:___ Aileron	RIGHT (clockwise) for RIGHT WING DOWN
Elevator	REARWARD TO pitch NOSE UP
Rudder	RIGHT pedal forward for NOSE RIGHT
Powerplant:___ Throttle	FORWARD to OPEN

03.381 Emergency provisions.

03.3811 Protection. The fuselage shall be designed to give every reasonable probability that all the occupants, if they make proper use of belts or harness for which provisions are made in the design, will escape serious injury in the event of the following minor crash conditions, although it is accepted that parts of the airplane may be damaged.

(a) Conditions in which the occupants experience the following ultimate acceleration forces in all combinations are as follows:

Category		N. U.	A
Upward	0 to:	3.0g	4.5g
Forward	0 to:	9.0g	9.0g
Sideward	0 to:	1.5g	1.5g

(b) For airplanes having retractable landing gear, the fuselage in combination with other portions of the structure shall be designed to afford protection of the occupants in a wheels-up landing with moderate descent velocity*.

(c) For airplanes other than those whose configuration renders the possibility of turnover remote, the fuselage in combination with other portions of the structure shall be designed to afford protection of the occupants in a complete turnover*.

*Note: In cases (b) and (c), a vertical ultimate acceleration of 3g and a friction coefficient of 0.5 at the ground may be assumed.

03.3812 Exits. Closed cabins on airplanes carrying more than 5 persons shall be provided with emergency exits in addition to the one external door required by § 03.3821, consisting of movable windows or panels or of additional external doors which provide a clear and unobstructed opening, the minimum dimensions of which shall be such that a 19-inch by 26-inch ellipse may be completely inscribed therein.

The number of emergency exits required is as follows:

(a) Airplanes with a total seating capacity of more than 5 persons, but not in excess of 15, shall be provided with at least one emergency exit or one suitable door in addition to the main door specified in § 03.3821. This emergency exit, or second door, shall be on the opposite side of the cabin from the main door.

(b) Airplanes with a seating capacity of more than 15 persons shall be provided with an additional emergency exit or door either in the top or side of the cabin for every additional 7 persons or fraction thereof above 15, except that not more than 4 exits, including doors, will be required if the arrangement and dimensions are suitable for quick evacuation of all occupants.

If the pilot compartment is separated from the cabin by a door, it shall have its own exit, but such exit shall not be considered as an emergency exit for the passengers. The exits shall be readily accessible, shall not require exceptional agility of a person using them, and shall be distributed so as to facilitate egress without crowding in all probable attitudes resulting from a crash. Reasonable provisions shall be made against the jamming of exits as a result of fuselage deformation.

The method of opening shall be simple and obvious, and the exits shall be so arranged and/or marked that they may be readily located and operated even in darkness. The proper functioning of exits shall be demonstrated by tests.

03.3812-UA Exits shall be provided that will permit all occupants to quickly bail out with parachutes.

03.3813 Fire precautions.

03.38131 Cabin interiors. In compartments where smoking is to be permitted, the materials of the cabin lining, floors, upholstery, and furnishings shall be sufficiently flame resistant to make ignition by cigarettes or matches improbable. All other compartments shall be placarded against smoking.

03.38132 Combustion heaters. Gasoline operated combustion heater installations shall comply with applicable parts of the powerplant installation requirements covering fire hazards and precautions. All applicable requirements concerning fuel tanks, lines, and exhaust systems shall be considered.

03.382 Personnel and cargo accomodations.

03.3821 Doors. Closed cabins on all airplanes carrying passengers shall be provided with at least one adequate and easily accessible external door. No passenger door shall be so located with respect to the propeller discs as to endanger persons using the door.

03.3822 Seats and berths. All seats and berths and supporting structure shall be designed for a passenger weight of 170 lbs. (190 lbs. with parachute for the acrobatic and utility category) and the maximum load factors corresponding to all specified flight and ground load conditions including the emergency conditions of § 03.3811.

Pilot seats shall be designed for the reactions resulting from the application of the pilot forces to the primary flight controls as specified in § 03.230.

03.3822-UA All seats designed to be occupied in the U and A categories under S 03.113 (c) (4) shall be designed to accomodate passengers.

X 03.38221 Safety belt or harness provisions. Provisions shall be made at all seats and berths designated as occupiable during take-off and landing for the installation of belts or harness necessary to comply with the emergency conditions of § 03.3811.

03.3823 Cargo compartments. Each cargo compartment shall be designed for the placarded maximum weight of contents and critical load distributions at the appropriate maximum load factors corresponding to all specified flight and ground load conditions. Suitable provisions shall be made to prevent the contents of cargo compartments from becoming a hazard by shifting. Such provisions shall be adequate to protect the passengers from injury by the contents of any cargo compartment when the ultimate forward acting acclerating force is 4.5g.

03.3824 Ventilation. All passenger and crew compartments shall be suitably ventilated. Carbon monoxide concentration shall not exceed one part in 20,000 parts of air.

03.39 Miscellaneous.

03.390 Leveling marks shall be provided for leveling the airplane on the ground.

03.4 POWER PLANT INSTALLATION--RECIPROCATING ENGINES

03.40 General.

(a) The power plant installation shall be considered to include all components of the airplane which are necessary for its propulsion. It shall also be considered to include all components which affect the control of the major propulsive units or which affect their continued safety of operation.

(b) All components of the power plant installation shall be constructed, arranged, and installed in a manner that will assure the continued safe operation of the airplane and power plant. Accessibility shall be provided to permit such inspection and maintenance as is necessary to assure continued airworthiness.

03.41 Engines and propellers.

03.410 Engines. Engines installed in certificated airplanes shall be of a type that has been certificated in accordance with the provisions of Part 13 entitled "Aircraft Engine Airworthiness".

03.411 Propellers.

(a) Propellers installed in certificated airplanes shall be of a type that has been certificated in accordance with the provisions of Part 14, entitled "Aircraft Propeller Airworthiness".

(b) The maximum engine power and propeller shaft rotational speed permissible for use in the particular airplane involved shall not exceed the corresponding limits for which the propeller has been certificated.

03.4110 Propeller vibration. In the case of airplanes equipped with metal propellers, the magnitude of the propeller blade vibration stresses under all normal conditions of operation shall be determined by actual measurements or by comparison with similar installations for which such measurements have been made. The vibration stresses thus determined shall not exceed values that have been demonstrated to be safe for continuous operation. Vibration tests may be waived and the propeller installation accepted on the basis of service experience, engine or gound tests which show adequate margins of safety, or other considerations which satisfactorily substantiate its safety in this respect.

03-4111 Propeller pitch and speed limitations. The propeller pitch and speed shall be limited to values that will assure safe operation under all normal conditions of operation and will assure compliance with the performance requirements specified in § 03.12, Performance, and its related sub-sections.

03.41110 Speed limitations for fixed pitch propellers, ground adjustable pitch propellers, and automatically varying pitch propellers which cannot be controlled in flight:

(a) During take-off and initial climb at best rate-of-climb speed, the propeller, in the case of fixed pitch or ground adjustable types, shall restrain the engine to a speed not exceeding its maximum permissible take-off speed and, in the case of automatic variable pitch types, shall limit the maximum governed engine RPM to a speed not exceeding the maximum permissible take-off speed. In demonstrating compliance with this provision the engine shall be operated at full throttle or the throttle setting corresponding to the maximum permissible take-off manifold pressure.

(b) During a closed throttle glide at the placard Never Exceed Speed (see § 03.6001), the propeller shall not cause the engine to rotate at a speed in excess of 110% of its maximum allowable continuous speed.

03.41111 Speed and pitch limitations for controllable pitch propellers without constant speed controls. The stops or other means incorporated in the propeller mechanism to restrict the pitch range shall limit

(a) the lowest possible blade pitch to a value that will assure compliance with the provisions of § 03.41110(a) and

(b) the highest possible blade pitch to a value not lower than the flattest blade pitch with which compliance with the provisions of § 03.41110(b) can be demonstrated.

03.41112 Variable pitch propellers with constant speed controls.

(a) Suitable means shall be provided at the governor to limit the speed of the propeller. Such means shall limit the maximum governed engine speed to a value not exceeding its maximum permissible take-off RPM.

(b) The low pitch blade stop, or other means incorporated in the propeller mechanism to restrict the pitch range, shall limit the speed of the propeller to a value not exceeding 102% of the maximum permissible take-off propeller shaft RPM under the following conditions:

(1) Propeller blades set in the lowest possible pitch and the governor inoperative.

(2) Engine operating at take-off manifold pressure with the airplane stationary and with no wind.

03.4112 Propeller clearance. With the airplane loaded to the maximum weight and most adverse center of gravity position and the propeller in the most adverse pitch position, propeller clearances shall not be less than the following unless smaller clearances are properly substantiated for the particular design involved:

(a) Ground clearance:

(1) Seven inches (for airplanes equipped with nose wheel type landing gears) or nine inches (for airplanes equipped with tail wheel type landing gears) with the landing gear statically deflected and the airplane in the level, normal take-off, or taxiing attitude, whichever is most critical.

(2) In addition to (1) above, there shall be positive clearance between the propeller and the ground when, with the airplane in the level take-off attitude, the critical tire is completely deflated and the corresponding landing gear strut is completely bottomed.

(b) Water clearance: 18 inches

(c) Structural clearance:

(1) One inch radial clearance between the blade tips and the airplane structure, or whatever additional radial clearance is necessary to preclude harmful vibration of the propeller or airplane.

(2) One-half inch longitudinal clearance between the propeller blades or cuffs and stationary portions of the airplane. Adequate positive clearance shall be provided between other rotating por-

tions of the propeller or spinner and stationary portions of the airplane.

03.42 Fuel system. The fuel system shall be constructed and arranged in a manner to assure the provision of fuel to each engine at a flow rate and pressure adequate for proper engine functioning under all normal conditions of operation including all maneuvers and acrobatics for which the airplane is intended.

03.421 Fuel system arrangement. Fuel systems shall be so arranged as to permit any one fuel pump to draw fuel from only one tank at a time. Gravity feed systems shall not supply fuel to any one engine from more than one tank at a time unless the tank air spaces are interconnected in such a manner as to assure that all interconnected tanks will feed equally. (See also § 03.4223.)

03.4210 Multi-engine fuel system arrangement. The fuel systems of multi-engine airplanes shall be arranged to permit operation in such a manner that the failure of any one component will not result in the loss of the power of more than one engine. Unless other provisions are made in order to comply with this requirement, the fuel system shall be arranged to permit supplying fuel to each engine through a system entirely independent of any portions of the system supplying fuel to the other engines.

03.4211 Pressure cross feed arrangements. Pressure cross feed lines shall not pass through portions of the airplane devoted to carrying personnel or cargo unless means are provided to permit the flight personnel to shut off the supply of fuel to these lines, or unless any joints, fittings, or other possible sources of leakage installed in such lines are enclosed in a fuel and fume proof enclosure that is ventilated and drained to the exterior of the airplane. Lengths of bare tubing need not be enclosed but shall be protected where necessary against possible inadvertent damage.

03.422 Fuel system operation.

03.4220 Fuel flow rate. The ability of the fuel system to provide the required fuel flow rate and pressure shall be demonstrated when the airplane is in the attitude which represents the most adverse condition from the standpoint of fuel feed and quantity of unusable fuel in the tank. During this test, fuel shall be delivered to the engine at the applicable flow rate (See § 03.42200, § 03.42201, and § 03.42202) at a pressure not less than the minimum required for proper carburetor operation. The quantity of fuel in the tank being tested shall not exceed the amount established as the unusable fuel supply for that tank (as determined by demonstration of compliance with the provisions of § 03.4221) (see also § 03.423 and § 03.5222) plus whatever minimum quantity of fuel it may be necessary to add for the purpose of conducting the flow test. If a fuel flowmeter is provided, the meter shall be blocked during the flow test and the fuel shall flow through the meter by-pass.

03.42200 Fuel flow rate for gravity feed systems. The fuel flow rate for gravity feed systems (main and reserve supply) shall be 1.2 pounds per hour for each take-off horsepower or 150% of the actual take-off fuel consumption of the engine, whichever is greater.

03.42201 Fuel flow rate for pump systems. The fuel flow rate for pump systems (main and reserve supply) shall be 0.9 pounds per hour for each take-off horsepower or 125% of the actual take-off fuel consumption of the engine, whichever is greater. This flow rate shall be applicable to both the primary engine-driven pump and to emergency pumps and shall be available when the pump is running at the speed at which it would normally be operating during take-off. In the case of hand-operated pumps, this speed shall be considered to be not more than 60 complete cycles (120 single strokes) per minute.

03.42202 Fuel flow rate for auxiliary fuel systems and fuel transfer systems. The provisions of § 03.42200 or § 03.42201, whichever is applicable, shall also apply to auxiliary and transfer systems with the exception of the fact that the required fuel flow rate shall be established upon the basis of maximum continuous power and speed instead of take-off power and speed. A lesser flow rate will be acceptable, however, in the case of a small auxiliary tank feeding into a large main tank provided a suitable placard is installed to require that the auxiliary tank must only be opened to the main tank when a predetermined satisfactory amount of fuel still remains in the main tank.

03.4221 Determination of unusable fuel supply and fuel system operation on low fuel.

(a) The unusable fuel supply for each tank shall be established as not less than the quantity at which the first evidence of malfunctioning occurs under the conditions specified below (see also § 03.423). In the case of airplanes equipped with more than one fuel tank, any tank which is not required to feed the engine in all of the conditions specified below need only be investigated for those flight conditions in which it shall be used and the unusable fuel supply for the particular tank in question shall then be based on the most critical of those conditions which are found to be applicable. In all such cases, information regarding the conditions under which the full amount of usable fuel in the tank can safely be used shall be made available to the operating personnel by means of a suitable placard or instructions in the Approved Operating Limitations.

Upon presentation of the airplane for test, the applicant shall stipulate the quantity of fuel with which he wishes to demonstrate compliance with this provision and shall also indicate which of the following conditions is most critical from the standpoint of establishing the unusable fuel supply. He shall also indicate the order in which the other conditions are critical from this standpoint:

(1) Level flight at maximum continuous power or the power required for level flight at V_c, whichever is less.

(2) Climb at maximum continuous power at the calculated best angle of climb at minimum weight.

(3) Rapid application of power and subsequent transition to best rate of climb following a power-off glide at 1.3 V_{s_0}.

(4) Sideslips and skids in level flight, climb, and glide under the conditions specified in (1), (2), and (3) above, of the greatest severity likely to be encountered in normal service or in turbulent air.

(b) In the case of Utility category airplanes, there shall be no evidence of malfunctioning during the execution of all approved maneuvers included in the Approved Operating Limitations. During this test the quantity of fuel in each tank shall not exceed the quantity established as the unusable fuel supply, in accordance with (a) above, plus 0.03 gallons for each maximum continuous horsepower for which the airplane is certificated.

(c) In the case of Acrobatic category airplanes, there shall be no evidence of malfunctioning during the execution of all approved maneuvers included in the Approved Operating Limitations. During this test the quantity of fuel in each tank shall not exceed that specified in (b) above.

(d) If an engine can be supplied with fuel from more than one tank, it shall be possible to regain the full power and fuel pressure of that engine in not more than 10 seconds (for single-engine airplanes) or 20 seconds (for multi-engine airplanes) after switching to any full tank after engine malfunctioning becomes apparent due to the deletion of the fuel supply in any tank from which the engine can be fed. Compliance with this provision shall be demonstrated in level flight.

(e) There shall be no evidence of malfunctioning during take-off and climb for one minute at the calculated attitude of best angle of climb at take-off power and minimum weight. At the beginning of this test the quantity of fuel in each tank shall not exceed that specified in (b) above.

03.4222 Fuel system hot weather operation. The fuel system shall be so arranged as to minimize the possibility of the formation of vapor lock in the system under all normal conditions of operation.

03.4223 Flow between interconnected tanks. In the case of gravity feed systems with tanks whose outlets are interconnected, it shall not be possible for fuel to flow between tanks in quantities sufficient to cause an overflow of fuel from the tank vent when the airplane is operated as specified in § 03.4221(a) and the tanks are full.

03.423 Fuel tanks. Fuel tanks shall be capable of withstanding without failure any vibration, inertia, fluid, and structural loads to which they may be subjected in operation. Flexible fuel tank liners shall be of an acceptable type. Integral type fuel tanks shall be provided with adequate facilities for the inspection and repair of the tank interior. The total usable capacity of the fuel tanks shall not be less than one gallon for each 7 maximum continuous rated horsepower for which the airplane is certificated. The unusable capacity shall be considered to be the minimum quantity of fuel that will permit compliance with the provisions of § 03.4221. The fuel quantity indicator shall be adjusted to account for the unusable fuel supply as specified in § 03.5222. If the unusable fuel supply in any tank exceeds 5% of the tank capacity or 1 gallon, whichever is greater, a placard and a suitable notation in the Approved Operating Limitations shall be provided to indicate to the flight personnel that the fuel remaining in the tank when the quantity indicator reads zero cannot be used safely in flight. The weight of the unusable fuel supply shall be included in the empty weight of the airplane.

03.4230 Fuel tank tests.

(a) Fuel tanks shall be capable of withstanding the following pressure tests without failure or leakage. These pressures may be applied in a manner simulating the actual pressure distribution in service:

(1) Conventional metal tanks and non-metallic tanks whose walls are not supported by the airplane structure: A pressure of 3.5 psi or the pressure developed during the maximum ultimate acceleration of the airplane with a full tank, whichever is greater.

(2) Integral tanks: The pressure developed during the maximum limit acceleration of the airplane with a full tank, simultaneously with the application of the critical limit structural loads.

(3) Non-metallic tanks whose walls are supported by the airplane structure: Tanks constructed of an acceptable basic tank material and type of construction and with actual or simulated support conditions, shall be subjected to a pressure of 2 psi for the first tank of a specific design. Subsequent tanks shall be production tested to at least 0.5 psi. The supporting structure shall be designed for the critical loads occurring in the flight or landing strength conditions combined with the fuel pressure loads resulting from the corresponding accelerations.

(b) Tanks with large unsupported or unstiffened flat areas shall be capable of withstanding the following tests without leakage or failure. The complete tank assembly, together with its supports, shall be subjected to a vibration test when mounted in a manner simulating the actual installation. The tank assembly shall be vibrated for 25 hours at an amplitude of not less than 1/32 of an inch while filled 2/3 full of water. The frequency of vibration shall be 90% of the maximum continuous rated speed of the engine unless some other frequency within the normal operating range of speeds of the engine is more critical, in which case the latter speed shall be employed and the time of test shall be adjusted to accomplish the same number of vibration cycles.

In conjunction with the vibration test, the tank assembly shall be rocked through an angle of 15° on either side of the horizontal (30° total) about an axis parallel to the axis of the fuselage. The assembly shall be rocked at the rate of 16 to 20 complete cycles per minute.

(c) Integral tanks which incorporate methods of construction and sealing not previously substantiated by satisfactory test data or service experience shall be capable of withstanding the vibration test specified in (b) above.

(d) Tanks with non-metallic liners shall be subjected to the sloshing portion of the test outlined under (b) above with fuel at room temperature.

In addition, a specimen liner of the same basic construction as that to be used in the airplane shall, when installed in a suitable test tank, satisfactorily withstand the slosh test with fuel at a temperature of 110°F.

03.4231 Fuel tank installation.

(a) The method of support for fuel tanks shall not be such as to concentrate the loads resulting from the weight of the fuel in the tanks. Pads shall be provided to prevent chafing between the tank and its supports. Materials employed for padding shall be non-absorbent or shall be treated to prevent the absorption of fluids. If flexible tank liners are employed, they shall be so supported that the liner is not required to withstand fluid loads. Interior surfaces of compartments for such liners shall be smooth and free of projections which may cause wear of the liner unless provisions are made for protection of the liner at such points or unless the construction of the liner itself provides such protection.

(b) Fuel tank compartments shall be ventilated and drained to prevent the accumulation of inflammable fluids or vapors. Compartments adjacent to tanks which are an integral part of the airplane structure shall also be ventilated and drained.

(c) Fuel tanks shall not be located on the engine side of the firewall. Not less than ½ of an inch of clear air space shall be provided between the fuel tank and the firewall. No portion of engine nacelle skin which lies immediately behind a major air egress opening from the engine compartment shall act as the wall of an integral tank. Fuel tanks shall not be located in personnel compartments except in the case of single-engine airplanes. In such cases fuel tanks whose capacity does not exceed 25 gallons may be located in personnel compartments if adequate ventilation and drainage is provided. In all other cases, fuel tanks shall be isolated from personnel compartments by means of fume and fuel proof enclosures.

03.4232 Fuel tank construction.

03.42320 Fuel tank expansion space. Fuel tanks shall be provided with an expansion space of not less than 2% of the tank capacity, unless the tank vent discharges clear of the aircraft in which case no expansion space will be required. It shall not be possible inadvertently to fill the fuel tank expansion space when the airplane is in the normal ground attitude.

03.42321 Fuel tank sump.

(a) Each tank shall be provided with a drainable sump having a capacity of not less than 0.25% of the tank capacity or 1/16 of a gallon, whichever is greater. The sump may be dispensed with if the fuel system is provided with a sediment bowl that will permit visual ground inspection for accumulations of water or other foreign material. The sediment bowl shall also be readily accessible for drainage. The capacity of the sediment chamber shall not be less than one ounce per each 20 gallons of the fuel tank capacity.

(b) If a fuel tank sump is provided, the capacity specified above shall be effective with the airplane in the normal ground attitude.

(c) If a separate sediment bowl is provided, the fuel tank outlet shall be so located that water will drain from all portions of the tank to the outlet when the airplane is in the ground attitude.

03.42322 Fuel tank filler connection. Fuel tank filler connections shall be marked as specified in § 03.6121.

Provision shall be made to prevent the entrance of spilled fuel into the fuel tank compartment or any portions of the airplane other than the tank itself. The filler cap shall provide a fuel tight seal for the main filler opening. However, small openings in the fuel tank cap for venting purposes or to permit passage of a fuel gauge through the cap shall be permissible.

03.42323 Fuel tank vents and carburetor vapor vents.

(a) Fuel tanks shall be vented from the top portion of the expansion space. Vent outlets shall be so located and constructed as to minimize the possibility of their being obstructed by ice or other foreign matter.

The vent shall be so constructed as to preclude the possibility of syphoning fuel during normal operation. The vent shall be of sufficient size to permit the rapid relief of excessive differences of pressure between the interior and exterior of the tank. Air spaces of tanks whose outlets are interconnected shall also be interconnected. There shall be no undrainable points in the vent line where moisture may accumulate with the airplane in either the ground or level flight attitude. Vents shall not terminate at points where the discharge of fuel from the vent outlet will constitute a fire hazard or from which fumes may enter personnel compartments.

(b) Carburetors which are provided with vapor elimination connections shall be provided with a vent line which will lead vapors back to one of the airplane fuel tanks. If more than one fuel tank is provided and it is necessary to use these tanks in a definite sequence for any reason, the vapor vent return line shall lead back to the fuel tank which must be used first unless the relative capacities of the tanks are such that return to another tank is preferable.

03.42324-A Fuel tank vents for acrobatic category airplanes. In the case of acrobatic type airplanes, provision shall be made to prevent excessive loss of fuel during acrobatic maneuvers including short periods of inverted flight. It shall not be possible for fuel to syphon from the vent when normal flight has been resumed after having executed any acrobatic maneuver for which the airplane is intended.

03.42325 Fuel tank outlet. The fuel tank outlet shall be provided with a screen of from 8 to 16 meshes per inch. If a finger strainer is used, the length of the strainer shall not be less than 4 times the outlet diameter. The diameter of the strainer shall not be less than the diameter of the fuel tank outlet. Finger strainers shall be accessible for inspection and cleaning.

03.424 Fuel pump and pump installation.

(a) If fuel pumps are provided to maintain a supply of fuel to the engine, at least one pump for each engine shall be directly driven by the engine. Fuel pumps shall be adequate to meet the flow requirements of the applicable portions of S 03.4220 and its related sections.

(b) Emergency fuel pumps shall be provided to permit supplying all engines with fuel in case of the failure of any one engine-driven pump unless the engine-driven pumps have been approved with the engines, in which case emergency pumps need not be provided. Similarly, if an engine fuel injection pump, which has been certificated as an integral part of the engine is used, an emergency pump will not be required. Emergency pumps shall be capable of complying with the same flow requirements as are prescribed for the main pumps. Hand emergency pumps shall not require excessive effort for their continued operation at the rate of 60 complete cycles (120 single strokes) per minute. Emergency pumps shall be available for immediate use in case of the failure of any other pump.

03.425 Fuel system lines, fittings, and accessories. Fuel lines shall be installed and supported in a manner that will prevent excessive vibration and will be adequate to withstand loads due to fuel pressure and accelerated flight conditions. Lines which are connected to components of the airplane between which relative motion may exist shall incorporate provisions for flexibility. Flexible hose shall be of an acceptable type.

03.4251 Fuel valves.

(a) Means shall be provided to permit the flight personnel to shut off rapidly the flow of fuel to any engine individually in flight. Valves provided for this purpose shall be located on the side of the firewall most remote from the engine.

(b) Shut-off valves shall be so constructed that it is possible for the flight personnel to reopen the valves rapidly after they have once been closed.

(c) Valves shall be provided with either positive stops or feel in the on and off positions and shall be supported in such a manner that loads resulting from their operation or from accelerated flight conditions are not transmitted to the lines connected to the valve. Valves shall be so installed that the effect of gravity and vibration will tend to turn their handles to the open rather than the closed position.

03.4252 Fuel strainer. A fuel strainer shall be provided between the fuel tank outlet and the carburetor inlet. If an engine-driven fuel pump is provided, the strainer shall be located between the tank outlet and the engine driven pump inlet. The strainer shall be accessible for drainage and cleaning, and the strainer screen shall be removable.

03.426 Fuel system drains. Drains shall be provided to permit safe drainage of the entire fuel system and shall incorporate means for locking in the closed position.

03.427 Fuel system instruments. See § 03.51 and § 03.522 through §. 03.5223.

03.43 Oil system. Each engine shall be provided with an independent oil system capable of supplying the engine with an ample quantity of oil at a temperature not exceeding the maximum which has been established as safe for continuous operation. The oil capacity of the system shall not be less than one gallon for every 25 gallons of fuel capacity. However, in no case shall the oil capacity be less than one gallon for each 75 maximum continuous horsepower of the engine(s) involved unless lower quantities can be substantiated.

03.430 Oil cooling. §ee S 03.44 and its related sections.

03.431 Oil tanks. Oil tanks shall be capable of withstanding without failure all vibration, inertia, and fluid loads to which they may be subjected in operation. Flexible oil tank liners shall be of an acceptable type.

03.4310 Oil tank tests. Oil tank tests shall be the same as fuel tank tests (see § 03.4230) except as follows:

(a) The 3.5 psi pressure specified in § 03.4230(a) shall be 5 pounds psi.

(b) In the case of tanks with non-metallic liners, the test fluid shall be oil rather than fuel as specified in § 03.4230(d) and the slosh test on a specimen liner shall be conducted with oil at a temperature of 250°F.

03.43120 Oil tank expansion space. Oil tanks shall be provided with an expansion space of not less than 10% of the tank capacity or $\frac{1}{2}$ gallon, whichever is greater. It shall not be possible inadvertently to fill the oil tank expansion space when the airplane is in the normal ground attitude.

03.43121 Oil tank filler connection. Oil tank filler connections shall be marked as specified in § 03.6121.

03.43122 Oil tank vent. Oil tanks shall be vented to the engine crankcase from the top of the expansion space in such a manner that the vent connection is not covered by oil under any normal flight conditions. Oil tank vents shall be so arranged that condensed water vapor that may freeze and obstruct the line cannot accumulate at any point.

03.43122-A Oil tank vents for acrobatic category airplanes. In the case of acrobatic type airplanes, provision shall be made to prevent hazardous loss of oil during acrobatic maneuvers including short periods of inverted flight.

03.43123 Oil tank outlet. The oil tank outlet shall not be enclosed or covered by any screen or other guard that may impede the flow of oil. The diameter of the oil tank outlet shall not be less than the diameter of the engine oil pump inlet. (See also § 03.436).

03.432 Oil system lines, fittings, and accessories. Oil lines shall comply with the provisions of § 03.425 except that the inside diameter of the engine oil inlet and outlet lines shall not be less than the diameter of the corresponding engine oil pump inlet and outlet.

03.4321 Oil valves. See § 03.49

03.4322 Oil radiators. Oil radiators and their supports shall be capable of withstanding without failure any vibration, inertia, and oil pressure loads to which they may normally be subjected.

03.4323 Oil filters. If the engine is equipped with an oil filter, the filter shall be constructed or installed in such a manner that complete blocking of the flow through the filter element will not jeopardize the continued operation of the engine oil supply system.

03.433 Oil system drains. Drains shall be provided to permit safe drainage of the entire oil system and shall incorporate means for positive locking in the closed position.

03.434 Engine breather line. Engine breather lines shall be so arranged that condensed water vapor which may freeze and obstruct the line cannot accumulate at any point. Breathers shall discharge in a location which will not constitute a fire hazard in case foaming occurs and so that oil emitted from the line will not impinge upon the pilot's windshield. The breather shall not discharge into the engine air induction system.

03.434-A Engine breather lines for acrobatic category airplanes: In the case of acrobatic type airplanes, provision shall be made to prevent excessive loss of oil from the breather during acrobatic maneuvers including short periods of inverted flight.

03.435 Oil system instruments. See § 03.51, § 03.522 through § 03.5221 and § 03.5224.

03.436 Propeller feathering system. If the propeller feathering system is dependent upon the use of the engine oil supply, provision shall be made to trap a quantity of oil in the tank in case the supply becomes depleted due to failure of any portion of the lubricating system other than the tank itself. The quantity of oil so trapped shall be sufficient to accomplish the feathering operation and shall be available only to the feathering pump. The ability of the system to accomplish feathering when the supply of oil has fallen to the above level shall be demonstrated.

03.44 Cooling. The power plant cooling provisions shall be capable of maintaining the temperatures of all power plant components, engine parts, and engine fluids (oil and coolant), at or below the maximum established safe value under critical conditions of ground and flight operation.

03.440 Cooling tests. Compliance with the provisions of S 03.44 shall be demonstrated under critical ground, water, and flight operating conditions. If the tests are conducted under conditions that deviate from the highest anticipated summer air temperature (see § 03.4400), the recorded power plant temperatures shall be corrected in accordance with the provisions of § 03.4401 and § 03.4402. The corrected temperatures determined in this manner shall not exceed the maximum established safe values. The fuel used during the cooling tests shall be of the minimum octane number approved for the engines involved, and the mixture settings shall be those used in normal operation. The test procedures shall be as outlined in § 03.4403 and § 03.4404.

03.4400 Maximum anticipated summer air temperatures. The maximum anticipated summer air temperature shall be considered to be 100°F at sea level and to decrease from this value at the rate of 3.6°F per thousand feet of altitude above sea level.

03.4401 Correction factor for cylinder head, oil inlet, carburetor air, and engine coolant inlet temperatures. These temperatures shall be corrected by adding the difference between the maximum anticipated summer air temperature and the temperature of the ambient air at the time of the first occurrence of maximum head, air, oil, or coolant temperature recorded during the cooling test. A correction factor other than 1.0 may be employed if it can be demonstrated to be applicable.

03.4402 Correction factor for cylinder barrel temperatures. Cylinder barrel temperatures shall be corrected by adding 0.7 of the difference between the maximum anticipated summer air temperature and the temperature of the ambient air at the time of the first occurrence of the maximum cylinder barrel temperature recorded during the cooling test. A correction factor other than 0.7 may be employed if it can be demonstrated to be applicable.

03.4403 Cooling test procedure for single-engine airplanes. This test shall be conducted by stabilizing engine temperatures in flight and then starting at the lowest practicable altitude and climbing for one minute at take-off power. At the end of one minute, the climb shall be continued at maximum continuous power until at least 5 minutes after the occurence of the highest temperature recorded. The climb shall not be conducted at a speed greater than the best rate-of-climb speed with maximum continuous power unless:

(a) the slope of the flight path at the speed chosen for the cooling test is equal to or greater than the minimum required angle of climb (see § 03.123(a)), and

(b) a cylinder head temperature indicator is provided as specified in § 03.5225.

03.4404 Cooling test procedure for multi-engine airplanes.

(a) Airplanes which meet the minimum one-engine inoperative climb performance specified in § 03.123(b): The engine cooling test for these airplanes shall be conducted with the airplane in the configuration specified in § 03.123(b) except that the operating engine(s) shall be operated at their maximum continuous power or at full throttle when above the critical altitude. After stabilizing temperatures in flight, the climb shall be started at the lower of the two following altitudes and shall be continued until at least 5 minutes after the highest temperature has been recorded:

(1) 1000 feet below the engine critical altitude or at the lowest practicable altitude (when applicable).

(2) 1000 feet below the altitude at which the single-engine inoperative rate of climb is $0.02V_{s_0}^2$.

The climb shall be conducted at a speed not in excess of the highest speed at which compliance with the climb requirement of § 03.123(b) can be shown. However, if the speed used exceeds the speed for best rate of climb with one engine inoperative, a cylinder head temperature indicator shall be provided as specified in § 03.5225.

(b) Airplanes which cannot meet the minimum one-engine inoperative climb performance specified in S 03.123-(b): The engine cooling test for these airplanes shall be the same as in (a) above except that, after stabilizing temperatures in flight, the climb (or descent, in the case of airplanes with zero or negative one-engine inoperative rate of climb) shall be commenced at as near sea-level as practicable and shall be conducted at the best rate-of-climb speed (or the speed of minimum rate of descent, in the case of airplanes with zero or negative one-engine inoperative rate of climb).

03.441 Liquid cooling systems. Each liquid cooled engine shall be provided with an independent cooling system. The coolant system shall be so arranged that no air or vapor can be trapped in any portion of the system, except the expansion tank, either during filling or during operation.

03.4410 Coolant tank. A coolant tank shall be provided. The tank capacity shall not be less than one gallon plus 10% of the cooling system capacity. Coolant tanks shall be capable of withstanding without failure all vibration, inertia, and fluid loads to which they may be subjected in operation. Coolant tanks shall be provided with an expansion space of not less than 10% of the total coolant system capacity. It shall not be possible inadvertently to fill the expansion space with the airplane in the normal ground attitude.

03.44100 Coolant tank tests. Coolant tank tests shall be the same as fuel tank tests (see § 03.4230) except as follows:

(a) The 3.5 psi pressure test of S 03.4230(a) shall be replaced by the sum of the pressure developed during the maximum ultimate acceleration with a full tank or a pressure of 3.5 psi, whichever is greater, plus the maximum working pressure of the system.

(b) In the case of tanks with non-metallic liners, the test fluid shall be coolant rather than fuel as specified in § 03.4230(d), and the slosh test on a specimen liner shall be conducted with coolant at operating temperature.

03.44101 Coolant tank installation. Coolant tanks shall be supported in a manner that distributes the tank loads over a large portion of the tank surface. Pads shall be provided to prevent chafing between the tank and the support. Material used for padding shall be non-absorbent or shall be treated to prevent the absorption of inflammable fluids.

03.44102 Coolant tank filler connection. Coolant tank filler connections shall be marked as specified in § 03.6121. Provisions shall be made to prevent to prevent the entrance of spilled coolant into the coolant tank compartment or any portions of the airplane other than the tank itself. Recessed coolant filler connections shall be drained and the drain shall discharge clear of all portions of the airplane.

03.4411 Coolant lines, fittings, and accessories. Coolant lines shall comply with the provisions of § 03.425 except that the inside diameter of the engine coolant inlet and outlet lines shall not be less than the diameter of the corresponding engine inlet and outlet connections.

03.44111 Coolant radiators. Coolant radiators shall be capable of withstanding without failure any vibration, inertia, and coolant pressure loads to which they may normally be subjected. Radiators shall be supported in a manner that will permit expansion due to operating temperatures and that will prevent the transmittal of harmful vibration to the radiator. If the coolant employed is inflammable, the air intake duct to the coolant radiator shall be so located that flames issuing from the nacelle in case of fire cannot impinge upon the radiator.

03.4412 Coolant system drains. One or more drains shall be provided to permit drainage of the entire coolant system, including the coolant tank, radiator, and the engine, when the airplane is in the normal ground attitude. Drains shall discharge clear of all portions of the airplane and shall be provided with means for positively locking the drain in the closed position. Coolant system drains shall be accessible.

03.4413 Coolant system instruments. See § 03.51, § 03.522 through § 03.5221.

03.45 Induction system. The engine air induction system shall permit supplying an adequate quantity of air to the engine under all conditions of operation.

Each engine shall be provided with at least 2 separate air intake sources except that, in the case of an engine equipped with a fuel injector, only one air intake source need be provided if the air intake, opening or passage is unobstructed by a screen, filter, or other part on which ice may form and so restrict the airflow as to adversely affect engine operation. Primary and alternate air intakes may open within the cowling only if that portion of the cowling is isolated from the engine accessory section by means of a fire resistant diaphragm. Alternate air intakes shall be located in a sheltered position. Supplying air to the engine through the alternate air intake system or the carburetor air pre-heater shall not result in the loss of excessive power in addition to the power lost due to the rise in the temperature of the air.

03.450 Induction system de-icing and anti-icing provisions. The engine air induction system shall incorporate means for the prevention and elimination of ice accumulations in accordance with the following provisions. It shall be demonstrated that compliance with the provisions outlined in the following paragraphs can be accomplished when the airplane is operating in air at a temperature of 30°F when the air is free of visible moisture. Lesser values may be used if properly substantiated.

(a) Airplanes equipped with sea level engines employing conventional venturi carburetors shall be provided with a preheater capable of providing a a heat rise of 90°F when the engine is operating at 75% of its maximum continuous power.

(b) Airplanes equipped with altitude engines employing conventional venturi carburetors shall be provided with a preheater capable of providing a heat rise of 120°F when the engine is operating at 75% of its maximum continuous power.

(c) Airplanes equipped with altitude engines employing carburetors which embody features tending to reduce the possibility of ice formation shall be provided with a preheater capable of providing a heat rise of 100°F when the engine is operating at 60% of its maximum continuous power. However, the preheater need not provide a heat rise in excess of 40°F if a fluid de-icing system complying with the provisions of § 03.4501 through § 03.4503 is also installed.

03.4501 Carburetor de-icing fluid flow rate. The system shall be capable of providing each engine with a rate of fluid flow, expressed in pounds per hour, of not less than 2.5 multiplied by the square root of the maximum continuous power of the engine. This flow shall be available to all engines simultaneously. The fluid shall be introduced into the air induction system at a point close to, and upstream from, the carburetor. The fluid shall be introduced in a manner to assure its equal distribution over the entire cross section of the induction system air passages.

03.4502 Carburetor fluid de-icing system capacity. The fluid de-icing system capacity shall not be less than that required to provide fluid at the rate specified in § 03.4501 for a time equal to 3% of the maximum endurance of the airplane. However, the capacity need not in any case exceed that required for 2 hours of operation nor shall it be less than that required for 20 minutes of operation at the above flow rate. If the available preheat exceeds 50°F but is less than 100°F, it shall be permissible to decrease the capacity of the system in proportion to the heat rise available in excess of 50°F.

03.4503 Carburetor fluid de-icing system detail design. Carburetor fluid de-icing systems shall comply with provisions for the design of fuel systems, except as heretofore specified, unless such provisions are manifestly inapplicable.

03.451 Carburetor air preheater design. Means shall be provided to assure adequate ventilation of the carburetor air preheater when the engine is being operated in cold air. The preheater shall be constructed in such a manner as to permit inspection of exhaust manifold parts which it surrounds and also to permit inspection of critical portions of the preheater itself.

03.452 Induction system ducts. Induction system ducts shall be provided with drains which will prevent the accumulation of fuel or moisture in all normal ground and flight attitudes. No open drains shall be located on the pressure side of turbo-supercharger installations. Drains shall not discharge in a location that will constitute a fire hazard. Ducts which are connected to components of the airplane between which relative motion may exist shall incorporate provisions for flexibility.

03.453 Induction system screens. If induction system screens are employed, they shall be located upstream from the carburetor. It shall not be possible for fuel to impinge upon the screen. Screens shall not be located in portions of the induction system which constitute the only passage through which air may reach the engine unless the available preheat is 100°F or over and the screen is so located that it can be de-iced by the application of heated air. De-icing of screens by means of alcohol in place of heated air shall not be considered acceptable.

03.46 Exhaust system. The exhaust system shall be constructed and arranged in such a manner as to assure the safe disposal of exhaust gases without the existence of a hazard of fire or carbon monoxide contamination of air in personnel compartments.

Unless suitable precautions are taken, exhaust system parts shall not be located in close proximity to portions of any systems carrying inflammable fluids or vapors nor shall they be located under portions of such systems which may be subject to leakage. All exhaust system components shall be separated from adjacent inflammable portions of the airplane which are outside the engine compartment by means of fire resistant shields. Exhaust gases shall not be discharged at a location that will cause a glare seriously affecting pilot visibility at night, nor shall they discharge within dangerous proximity of any fuel or oil system drains. All exhaust system components shall be ventilated to prevent the existence of points of excessively high temperature.

03.461 Exhaust heat exchangers. Exhaust heat exchangers shall be constructed and installed in such a manner as to assure their ability to withstand without failure all vibration, inertia, and other loads to which they may normally be subjected. Heat exchangers shall be constructed of materials that are suitable for continued operation at high temperatures and that are adequately resistant to corrosion due to products contained in exhaust gases.

Provision shall be made for the inspection of all critical portions of exhaust heat exchangers, particularly if a welded construction is employed. Heat exchangers shall be ventilated under all conditions in which they are subject to contact with exhaust gases.

03.4610 Exhaust heat exchangers used in ventilating air heating systems. Heat exchangers of this type shall be so constructed as to preclude the possibility of exhaust gases entering the ventilating air.

03.47 Firewall and cowling.

03.470 Firewalls. All engines and auxiliary power plants which are intended for operation in flight shall be isolated from the remainder of the airplane by means of fire resistant bulkheads unless they are located in a nacelle that is remote from the remainder of the airplane and contains no fuel tanks.

03.4700 Firewall construction. The firewall shall be constructed in such a manner as to minimize the passage of air, fluids, or flame from the engine compartment to other portions of the airplane. All openings in the firewall shall be sealed with close fitting fire resistant grommets, bushings, or firewall fittings.

Firewalls shall be constructed of fire resistant material capable of withstanding a flame temperature of 2000°F for 15 minutes without flame penetration and shall be protected against corrosion. The following materials have been found to comply with this requirement.

(a) Heat and corrosion resistant steel 0.015 inches thick

(b) Low carbon steel, suitably protected against corrosion, 0.018 inches thick.

03.471 Cowling. Cowling shall be constructed and supported in such a manner as to be capable of resisting all vibration, inertia, and air loads to which it may normally be subjected. Provision shall be made to permit rapid and complete drainage of all portions of the cowling in all normal ground and flight attitudes. Drains shall not discharge in locations constituting a fire hazard.

Cowling shall be constructed of non-inflammable material. All portions of the airplane lying behind openings in the engine compartment cowling shall also be constructed of non-inflammable materials for a distance of at least 24 inches aft of such openings. Portions of cowling which are subjected to high temperatures due to proximity to exhaust system ports or exhaust gas impingement shall be constructed of heat resistant material.

03.48 Power plant controls and accessories.

03.480 Power plant controls. Power plant controls shall comply with the provisions of § 03.3802 with respect to direction of motion and shall comply with the provisions of S.03.6102 with respect to marking. Controls shall maintain any necessary position without constant attention by the flight personnel and shall not tend to creep due to control loads or vibration. Flexible controls shall be of an acceptable type. Controls shall have adequate strength and rigidity to withstand operating loads without failure or excessive deflection.

03.4800 Throttle controls. A throttle control shall be provided to give independent control for each engine. Throttle controls shall afford a positive and immediately responsive means of controlling the engine(s). Throttle controls shall be grouped and arranged in such a manner as to permit separate control of each engine and also simultaneous control of all engines.

03.4801 Ignition switches. Ignition switches shall provide control for each ignition circuit on each engine. Means shall be provided for quickly shutting off all ignition on multi-engine airplanes, by the grouping of switches or by providing a master ignition control. If a master control is provided, suitable means shall be incorporated to prevent its inadvertent operation.

03.4802 Mixture controls. If mixture controls are provided, a separate control shall be provided for each engine. The controls shall be grouped and arranged in such a manner as to permit separate control of each engine and also simultaneous control of all engines.

03.4803 Propeller speed and pitch controls. (See also S 03.41112 (a)). If propeller speed or pitch controls are provided, a separate control shall be provided for each propeller. The controls shall be grouped and arranged in such a manner as to permit control of the propellers separately and together. The controls shall permit ready synchronization of all propellers on multi-engine airplanes.

03.48030 Propeller feathering controls. If propeller feathering controls are provided, a separate control shall be provided for each propeller. Propeller feathering controls shall be provided with means to prevent inadvertent operation.

03.4804 Fuel system controls. See § 03.4251(c).

03.4805 Carburetor air preheat controls. Separate controls shall be provided to regulate the temperature of the carburetor air for each engine.

03.481 Power plant accessories. Engine-driven accessories shall be of a type satisfactory for installation on the engine involved and shall utilize the provisions made on the engine for the mounting of such units. Items of electrical equipment subject to arcing or sparking shall be installed so as to minimize the possibility of their contact with any inflammable fluids or vapors which may be present in a free state.

03.4810 Engine ignition systems.

(a) Battery ignition systems shall be supplemented with a generator which is automatically made available as an alternate source of electrical energy to permit continued engine operation in the event of the depletion of any battery.

(b) The capacity of batteries and generators shall be sufficient to meet the simultaneous demands of the engine ignition system and the greatest demands of any airplane electrical system components which may draw electrical energy from the same source. Consideration shall be given to the condition of an inoperative generator and to the condition of a completely depleted battery when the generator is running at its normal operating speed. If only one battery is provided, consideration shall also be given to the condition in which the battery is completely depleted and the generator is operating at idling speed.

(c) Means shall be provided to warn the appropriate flight personnel if malfunctioning of any part of the electrical system is causing the continuous discharging of a battery that is necessary for engine ignition. (See § 03.4801 for ignition switches).

03.49 Power plant fire protection. Suitable means shall be provided to shut off the flow in all lines carrying inflammable fluids into the engine compartment.

03.5 EQUIPMENT

03.50 General. The equipment specified in § 03.51 shall be the minimum installed when the airplane is submitted to determine its compliance with the airworthiness requirements. Such additional equipment as is necessary for a specific type of operation is specified in other pertinent parts of the CAR, but where necessary, its installation and that of the items mentioned in § 03.51 is covered herein.

03.500 Functional and installational requirements. Each item of equipment which is essential to the safe operation of the airplane shall be of a type and design found to be satisfactory by the Administrator, shall be properly installed, shall function satisfactorily, and shall be adequately labeled as to its identification, function, or operational limitations, or any combination of these, whichever is applicable. Items of equipment for which type certification is required shall have been certificated in accordance with the provisions of Part 15 (or previous regulations) and such other Parts as may be applicable.

03.51 Required basic equipment. The following table shows the required basic equipment items necessary for type and airworthiness certification of an airplane:

(a) Flight and navigation instruments:
  (1) Air speed indicator (See § 03.5210)
  (2) Altimeter
  (3) Magnetic direction indicator (See § 03.5213)
(b) Power plant instruments:

(b-1) For each engine or tank:
    (1) Fuel quantity indicator (See § 03.5222)
    (2) Oil pressure indicator
    (3) Oil temperature indicator
    (4) Tachometer
(b-2) For each engine or tank when required in reference section:
    (1) Carburetor air temperature indicator (See § 03.5226)
    (2) Coolant temperature indicator, liquid cooled engines
    (3) Cylinder head temperature indicator (See § 03.5225)
    (4) Fuel pressure indicator, pump-fed engines
    (5) Manifold pressure indicator for altitude engines
    (6) Oil quantity indicator (See § 03.532)
(c) Electrical equipment: (when required by reference section)
    (1) Master switch arrangement (See § 03.532)
    (2) Adequate source(s) of electrical energy (See S 03.530 and § 03.531)
    (3) Electrical protective devices (See § 03.533)
(d) Miscellaneous equipment:
    (1) Certificated safety belts for all occupants (Part 15)
    (2) Approved Operating Limitations (See § 03.62)

03.52 Instruments - installation

03.520 General.

03.5200 Arrangement and visibility of instrument installations.
(a) Flight, navigation, and power plant instruments for use by each pilot shall be easily visible to him.
(b) On multi-engine airplanes, identical power plant instruments for the several engines shall be so located as to prevent any mis-leading impression as to the engines to which they relate.

03.5201 Instrument panel vibration characteristics. The vibration characteristics of instrument panel shall not be such as to cause the accuracy of the instruments to be inadequate or to cause damage to them.

03.521 Flight and navigation instruments.

03.5210 Airspeed indicating system. This system shall be so installed that the airspeed indicator shall indicate true airspeed at sea level under standard conditions to within an allowable installational error of not more than plus or minus 3% of the calibrated air speed or 5 mph, whichever is greater, throughout the operating range of the airplane from V_c to 1.3 V_{s1} and with flaps both up and down at the latter speed.

03.5211 Airspeed indicator marking. The airspeed indicator shall be marked as specified in § 03.6100.

03.512 Static air vent system. All instruments provided with static air case connections shall be so vented that the influence of airplane speed, the opening and closing of windows, air flow variation, moisture, or other foreign matter will not seriously affect their accuracy.

03.5213 Magnetic direction indicator. The magnetic direction indicator shall be so installed that its accuracy shall not be excessively affected by the airplane's vibration or magnetic fields. After the direction indicator has been compensated, the installation shall be such that the deviation in level flight does not exceed 10° on any heading. A suitable calibration placard shall be provided as specified in § 03.6101.

03.5214 Automatic pilot system. If an automatic pilot system is installed:

(a) The actuating (servo) devices shall be of such design that they can, when necessary, be positively disengaged from operating the control system or be overpowered by the human pilot to enable him to maintain satisfactory control of the airplane.

(b) A satisfactory means shall be provided to indicate readily to the pilot the alignment of the actuating device in relation to the control system which it operates, except when automatic synchronization is provided.

(c) The manually operated control(s) for the system's operation shall be readily accessible to the pilot.

(d) The automatic pilot system shall be of such design and so adjusted that it cannot produce loads in the control system and surfaces greater than those for which they were designed.

03.5215 Gyroscopic indicators (air-driven type). All air-driven gyroscopic instruments installed in airplanes which are certificated for "Instrument Flight Operations" shall derive their energy from a reliable suction source of sufficient capacity to maintain their required accuracy at all speeds above the best rate-of-climb speed. In addition, the system shall be so installed as to preclude malfunctioning due to rain, oil, etc. On multi-engine airplanes, the following detail requirements shall be applicable:

(a) Two sources actuated by separate means shall be provided, either one of which shall be of sufficient capacity to operate, at the service ceiling of the airplane in normal cruising condition, all of the air-driven gyroscopic instruments with which the airplane is equipped.

(b) A suitable means shall be provided in the attendant installation where the source lines connect into a common line to select either suction air source for the proper functioning of the instruments should failure of one source or a breakage of one source line occur. When an automatic means to permit simultaneous air flow is provided in the system, a suitable method for maintaining suction shall be provided. In order to indicate which source of energy has failed, a visual means shall be provided to indicate this condition to the flight crew.

03.5216 Suction gauge. When required by § 03.5215(b), the suction gauge or equivalent shall be so installed as to indicate readily to the flight crew while in flight, which source of suction is being applied to the air-driven types of gyroscopic instruments.

03.522 Power plant instruments.

03.5220 Operational markings. Instruments shall be marked as specified in § 03.6102.

03.5221 Instrument lines. Power plant instrument lines shall comply with the provisions of § 03.425. In addition, instrument lines carrying inflammable fluids or gases under pressure shall be provided with restricted orifices or equivalent safety devices at the source of the pressure to prevent escape of excessive fluid or gas in case of line failure.

03.5222 Fuel quantity indicator. Means shall be provided to indicate to the flight personnel the quantity of fuel in each tank during flight. Tanks whose outlets and air spaces are interconnected may be considered as one tank and need not be provided with separate indicators. Exposed sight gauges shall be so installed and guarded as to preclude the possibility of breakage or damage. Fuel quantity indicators shall be calibrated to read zero during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel supply as defined by § 03.4221.

03.5223. Fuel flowmeter system. When a fuel flowmeter system is installed in the fuel line(s), the metering component shall be of such design as to include a suitable means for by-passing the fuel supply in the event that malfunctioning of the metering component offers a severe restriction to fuel flow.

03.5224 Oil quantity indicator. Ground means, such as a stick gauge, shall be provided to indicate the quantity of oil in each tank. If an oil transfer system or a reserve oil supply system is installed, means shall be provided to indicate to the flight personnel the quantity of oil in each tank during flight.

03.5225 Cylinder head temperature indicating system for aircooled engines. A cylinder head temperature indicator shall be provided for each engine on airplanes equipped with cowl flaps. In the case of airplanes which do not have cowl flaps, an indicator shall be provided if compliance with the provisions of § 03.44 is demonstrated at a speed in excess of the speed of best rate of climb (one engine inoperative on multi-engine airplanes).

03.5226 Carburetor air temperature indicating system. A carburetor air temperature indicating system shall be provided for each altitude engine equipped with a preheater that is capable of providing a heat rise in excess of 60°F.

03.53 Electrical systems and equipment - installation. Electrical systems in airplanes shall be free from hazards in themselves, in their method of operation, and in their effects on other parts of the airplane. Electrical equipment shall be of a type and design adequate for the use intended. Electrical systems shall be installed in such a manner that they are suitably protected from fuel, oil, water, other detrimental substances, and mechanical damage.

Items of electrical equipment required for a specific type of operation are listed in other pertinent Parts of the CAR.

03.530 Batteries. When an item of electrical equipment which is es-
ential to the safe operation of the airplane is installed, the battery re-
ired shall have sufficient capacity to supply the electrical power nec-
sary for dependable operation of the connected electrical equipment.

03.5300 Protection against acid. If batteries are of such a type that
osive substance may escape during servicing or flight, means such as a
letely enclosed compartment shall be provided to prevent such substances
coming in contact with other parts of the airplane which are essential
e operation. Batteries shall be accessible for servicing and inspec-
n the ground.

.5301 Battery vents. The battery container or compartment shall be
n such manner that gases released by the battery are carried outside
lane.

03.531 Generator. Generators shall be capable of delivering their continuous rated power.

03.5310 Generator controls. Generator voltage control equipment shall be capable of dependably regulating the generator output within rated limits.

03.5311 Reverse current cut-out. A generator reverse current cut-out shall disconnect the generator from the battery and other generators when the generator is developing a voltage of such value that current sufficient to cause malfunctioning can flow into the generator.

03.532 Master switch. If electrical equipment is installed, a master switch arrangement shall be provided which will disconnect all sources of electrical power from the main distribution system at a point adjacent to the power sources.

03.5320 Master switch installation. The master switch or its controls shall be so installed that it is easily discernible and accessible to a member of the crew in flight.

03.533 Protective devices. If electrical equipment is installed, protective devices (fuses or circuit breakers) shall be installed in the circuits to all electrical equipment except that such items need not be installed in the main circuits of starter motors or in other circuits where no hazard is presented by their omission.

03.5330 Protective devices installation. Protective devices in circuits essential to safety in flight shall be so located and identified that fuses may be replaced or circuit breakers reset readily in flight.

03.5331 Spare fuses. If fuses are used, one spare of each rating or 50% spare fuses of each rating, whichever is greater, shall be provided.

03.534 Electric cables. If electrical equipment is installed, the connecting cable used shall be in accordance with recognized standards for electric cable of a slow burning type and of suitable capacity.

03.535 Switches. Switches shall be capable of carrying their rated current and shall be of such construction that there is sufficient distance or insulating material between current carrying parts and the housing so that vibration in flight will not cause shorting.

03.5350 Switch installation. Switches shall be so installed as to be readily accessible to the appropriate crew member and shall be suitably labeled as to operation and the circuit controlled.

03.536 Instrument lights. If instrument lights are required, they shall be of such construction that there is sufficient distance or insulating material between current carrying parts and the housing so that vibration in flight will not cause shorting. They shall provide sufficient illumination to make all instruments, switches, etc., easily readable and discernible respectively.

03.5360 Instrument light installation. Instrument lights shall be installed in such a manner that their direct rays are shielded from the pilot's eyes. Direct rays shall not be reflected from the windshield or other surfaces into the pilot's eyes.

03.537 Landing lights. If landing lights are installed, they shall be of a type acceptable to the Administrator.

03.5370 Landing light installation. Landing lights shall be so installed that there is no dangerous glare visible to the pilot and also so that the pilot is not seriously affected by halation. They shall be installed at such a location that they provide adequate illumination for night landing.

03.538 Position lights. If position lights are installed, they shall be of a type certificated in accordance with Part 15 or shall comply with the pertinent provisions of Part 15.

03.5380 Forward position light installation. Forward position lights shall be so installed that, with the airplane in normal flying position, the red light is displayed on the left side and the green light on the right side, each showing unbroken light between two vertical planes whose dihedral angle is 110° when measured to the left and right, respectively, of the airplane from dead ahead. The lights shall be spaced laterally as far apart as practicable.

03.5381 Rear position light installation. The rear position light shall be mounted as far aft as practicable and so installed that unbroken light is directed symmetrically aft in such a manner that the axis of the maximum cone of illumination is parallel to the flight path. In addition, the intersection of the two planes forming dihedral angle A given in Part 15 shall be vertical.

03.5382 Flashing rear position lights. If red and white flashing lights are used, in addition to meeting the installation requirements above, they shall be located as close together as possible.

03.539 Riding light. When a riding (anchor) light is required for seaplanes and amphibians, at least one light shall be provided and it shall be capable of showing a white light for at least 2 miles at night under clear atmospheric conditions.

03.5390 Riding light installation. Riding lights shall be so installed that they will show the maximum unbroken light practicable when the airplane is moored or drifting on the water. Externally hung lights are permitted.

03.54 Safety equipment - installation.

03.540 Marking. Required safety equipment which the crew is expected to operate at the time of an emergency, such as flares, automatic life raft releases, etc., shall be readily accessible and plainly marked as to its method of operation. When such equipment is carried in lockers, compartments, etc., such storage places shall be marked for the benefit of passengers and crew.

03.541 De-icers. When pneumatic de-icers are installed, the installation shall be in accordance with approved data. Positive means shall be provided for the deflation of the pneumatic boots.

03.542 Flares.

03.5420 Flare requirements. When parachute flares are required, they shall be of a type certificated in accordance with Part 15.

03.5421 Flare installation. Parachute flares shall be releaseable from the pilot compartment and so installed that danger from accidental discharge is reduced to a minimu. The installation shall be demonstrated, in flight, satisfactorily to eject flares except in those cases where inspection indicates a ground test will be adequate. If the flares are ejected so that recoil loads are involved, structural provisions for such loads shall be made.

03.543 Safety belts. Safety belts shall be of a type certificated in accordance with Part 15. They shall be so attached that no part of the anchorage will fail at a lower load than that specified in § 03.3811.

03.544 Emergency flotation and signaling equipment.

03.5440 Requirement. An approved life raft or approved life preserver when required by Part 43, is one approved by either the Administrator, the Bureau of Marine Inspection and Navigation, the U. S. Army Air Forces, or the Bureau of Aeronautics, Navy Department.

03.5441 Installation of rafts and life preservers. When such emergency equipment is required, it shall be so installed as to be readily available to the crew and passengers. Rafts released automatically or by the pilot shall be attached to the airplane by means of a line to keep them adjacent to the airplane. The strength of the line shall be such that it will break before submerging the empty raft.

03.5442 Signaling device. Signaling devices, when required by Part 43, shall be accessible, shall function satisfactorily, and be free from any hazard in their operation.

03.55 Radio equipment - installation.

03.550 General. Radio equipment and installations in the airplane shall be free from hazards in themselves, in their method of operation, and in their effects on other components of the airplane.

03.56 Miscellaneous equipment - installation.

03.560 Accessories for multi-engine airplanes. Engine driven accessories essential to the safe operation of the airplane shall be so installed as to continue to operate despite the failure of any one engine.

03.561 Hydraulic systems.

03.5610 General. Hydraulic systems and elements shall be so designed as to withstand, without exceeding the yield point, any structural loads which may be imposed in addition to the hydraulic loads.

03.5611 Tests. Hydraulic systems shall be substantiated by proof pressure tests. When proof tested, no part of the hydraulic systems shall fail, malfunction, or experience a permanent set. The proof load of any system shall be 1.5 times the maximum operating pressure of that system.

03.5612 Lines. All hydraulic oil lines carrying inflammable fluids into a designated fire zone shall be constructed in accordance with § 03.49.

03.5613 Accumulators. Hydraulic accumulators or pressurized reservoirs shall not be installed on the engine side of the firewall.

03.6 OPERATING LIMITATIONS AND INFORMATION

03.6 Operating limitations and information. Means shall be provided by which the pilot and other appropriate crew members are adequately informed of all operating limitations upon which the type design is based. Any other information concerning the airplane found by the Administrator to be necessary for safety during its operation shall also be made available to the crew.

03.60 Limitations. The operating limitations specified in the following subsections and any similar limitations shall be established for any airplane and made available to the operator as further described in § 03.61 and § 03.62, unless its design is such that they are unnecessary for safe operation.

03.600 Airspeed. The following airspeed limitations shall be established.

03.6001 Never exceed speed. (Vne) This speed shall not exceed the lesser of the following:

(a) $0.9V_d$ chosen in accordance with S 03.2110,

(b) 0.9 times the maximum speed demonstrated in accordance with § 03.15, but shall not be less than 0.9 times the minimum value of V_d permitted by § 03.2110.

03.6002 Maximum structural cruising speed. This operating limitation shall be:

(1) not greater than V_c chosen in accordance with § 03.2110,
(2) not greater than 0.89 times Vne established under § 03.6001,
(3) not less than the minimum V_c permitted in § 03.2110.

03.6003 Maneuvering speed. (See § 03.2110)

03.6004 Flaps extended speed. This speed shall not exceed the lesser of the following:

(a) The design flap speed, V_f, chosen in accordance with § 03.212,

(b) The flap design speed chosen in accordance with § 03.224, but shall not be less than the minimum value of flap design speed permitted in § 03.212 and § 03.224.

03.6005 Minimum control speed. (See § 03.1312).

03.601 Power plant. The following power plant limitations shall be established and shall not exceed the corresponding limits established as a part of the type certification of the engine and propeller installed in the airplane.

03.6011 Take-off operation.

(a) Maximum rotational speed (RPM)
(b) Maximum permissible manifold pressure, if applicable
(c) The time limit upon the use of the corresponding power
(d) Where the time limit of Item (c) exceeds 2 minutes, the maximum allowable cylinder head or coolant outlet, and oil temperatures.

03.6012 Maximum continuous operation.

(a) Maximum rotational speed (RPM)
(b) Maximum permissible manifold pressure, if applicable
(c) Maximum allowable cylinder head or coolant outlet, and oil temperatures

03.6013 Fuel octane rating. The minimum octane rating of fuel required for atisfactory operation of the power plant at the limits of § 03.6011 and § 03.6012.

03.602 Airplane weight. The airplane weight and c. g. limitations are those equired to be determined by § 03.11.

03.603 Minimum flight crew. The minimum flight crew shall be established as hat number of persons required for the safe operation of the airplane during any ontact flight as determined by the availability and satisfactory operation of all ecessary controls by each operator concerned.

03.604 Types of operation. The type of operation to which the airplane is imited shall be established by the category in which it has been found eligible or certification and by the equipment installed (See Part 43 and other pertinent arts of the CAR.)

03.61 Marks and placards. The markings and placards specified are required or all airplanes. Placards shall be displayed in a conspicuous place and both hall be such that they may not be easily erased, disfigured, or obscured. Addtional information placards and instrument markings having a direct and important earing on safe operation may be required when unusual design, operating, or handing characteristics so warrant.

03.610 Instrument markings. The instruments listed below shall have the ollowing limitations marked thereon. When these markings are placed on the cover lass of the instrument, adequate provisions shall be made to maintain the correct lignment of the glass cover with the face dial. All arcs and lines shall be of ufficient width and so located as to be clearly and easily visible to the pilot.

03.6100 Airspeed indicator. True indicated airspeed shall be used.

(a) The Never Exceed Speed, Vne,- a radial red line (See § 03.6001.)

(b) The caution range - a yellow arc extending from the red line in a) above to the upper limit of the green arc specified in (c) below.

(c) The normal operating range - a green arc with the lower limit at $_{s_1}$, as determined in § 03.121 with maximum weight, landing gear and wing flaps etracted, and the upper limit at the Maximum Structural Cruising speed established n § 03.6002.

(d) The flap operating range - a white arc with the lower limit at $_{s_0}$ as determined in § 03.121 at the maximum weight, and the upper limit at the laps extended speed in § 03.6004.

When the Never Exceed and Maximum Structural Cruising speeds vary with ltitude, means shall be provided which will indicate the appropriate limitation o the pilot throughout the operating altitude range.

03.6101 Magnetic direction indicator. A placard shall be installed on or in lose proximity to the magnetic direction indicator which contains the calibration f the instrument in a level flight attitude with engine(s) operating and radio eceiver(s) on or off (which shall be stated). The calibration readings shall be hose to known magnetic headings in not less than 30° increments.

03.6102 Powerplant instruments. All required powerplant instruments shall e marked with a red radial line at the maximum, and minimum (if applicable) inications for safe operation. The normal operating ranges shall be marked with green arc which shall not extend beyond the maximum and minimum limits for coninuous operation. Take-off and precautionary ranges shall be marked with a ellow arc.

03.6103 Oil quantity indicators. Indicators shall be suitably marked in sufficient increments so that they will readily and accurately indicate the quantity of oil.

03.6104 Fuel quantity indicator. When the unusable fuel supply for any tank exceeds 1 gallon or 5% of the tank capacity, whichever is greater, a red band shall be placed on the indicator which extends from the calibrated zero reading (See § 03.4221) to the lowest reading obtainable in the level flight attitude, and a suitable notation in the Approved Operating Limitations shall be provided to indicate to the flight personnel that the fuel remaining in the tank when the quantity indicator reaches zero cannot be used safely in flight. (See § 03.5222).

03.611 Control markings. All cockpit controls, with the exception of the primary flight controls, shall be plainly marked and/or identified as to their function and method of operation.

03.6110 Aerodynamic controls. The secondary controls shall be suitably marked to comply with § 03.352 and § 03.353.

03.6111 Powerplant fuel controls.

(a) Controls for fuel tank selector valves shall be marked to indicate the position corresponding to each tank and any cross feed positions that may exist.

(b) When more than one fuel tank is provided, and if safe operation depends upon the use of tanks in a specific sequence, the fuel tank selector controls shall be marked adjacent to or on the control to indicate to the flight personnel the order in which the tanks should be used.

(c) On multi-engine airplanes, controls for engine valves shall be marked to indicate the position corresponding to each engine.

(d) The capacity of each tank shall be indicated adjacent to or on the fuel tank selector control.

03.6112 Accessory and auxiliary controls.

(a) When a retractable landing gear is used, the visual indicator required in § 03.3622 shall be marked in such a manner that the pilot, at all times, can ascertain when the wheels are secured in either extreme position.

(b) Emergency controls shall be colored red and clearly marked as to their method of operation.

03.612 Miscellaneous markings and placards.

03.6120 Baggage compartments, ballast location, and special seat loading limitations.

(a) Each baggage or cargo compartment and ballast location shall bear a placard which states the maximum allowable weight of contents and, if applicable, any special limitation of contents due to loading requirements, etc.

(b) When the maximum permissible weight to be carried in a seat is less than 170 lbs. (see § 03.113), a placard shall be permanently attached to the seat structure which states the maximum allowable weight of occupant to be carried.

03.6121 Fuel, oil, and coolant filler openings. The following information shall be marked on or adjacent to the filler cover in each case:

(a) The word "fuel", the minimum permissible fuel octane number for the engines installed, and the usable fuel tank capacity (See § 03.4221)

gas red
oil yellow

(b) The word "oil" and the oil tank capacity

(c) The name of the proper coolant fluid and the capacity of the coolant system.

03.6122 Emergency exit placards. Emergency exit placards and operating controls shall be colored red. A placard shall be located adjacent to the control(s) which clearly indicates it to be an emergency exit and describes the method of operation. (See § 03.3812).

03.6123 Approved flight maneuvers.

03.6123-N A placard shall be provided in front of and in clear view of the pilot station: "No acrobatic maneuvers including spins approved."

03.6123-U A placard shall be provided in front of and in clear view of the pilot stating: "No acrobatic maneuvers approved except those listed below:

Maneuver	Entry Speed
*	*

(List here all authorized maneuvers
and the recommended entry airspeeds.)

03.6123-A A placard shall be provided in clear view of the pilot which lists all approved acrobatic maneuvers and the recommended entry airspeed for each. If inverted flight maneuvers are not approved, then the placard shall bear a notation to this effect.

03.6124 Weight and loading distribution placard. A placard shall be provided in front of and in clear view of the pilot(s) stating: "This airplane must be operated in compliance with the Approved Operating Limitations."

03.62 Approved Operating Limitations. "Approved Operating Limitations" shall be furnished with each airplane. The portions of this document listed below shall be verified and approved by the Administrator. Additional items of information having a direct and important bearing on safe operation may be required when unusual design, operating, or handling characteristics so warrant.

03.620 Operating limitations.

(a) Airspeed limitations - Sufficient information shall be included to permit proper marking of the airspeed limitations on the indicator as required in § 03.6100. It shall also include the design maneuvering speed and the maximum safe airspeed at which the landing gear can be safely lowered. In addition to the above information, the significance of the airspeed at which the landing gear can be safely lowered. In addition to the above information, the significance of the airspeed limitations and of the color coding used shall be explained.

(b) Powerplant limitations - Sufficient information shall be included to outline and explain all powerplant limitations (see § 03.601) and to permit marking the instruments as required in § 03.6102.

(c) Weight - The following information shall be included:

(1) Maximum weight for which the airplane has been certificated.

(2) Airplane empty weight and center of gravity location

(3) Useful load

(4) The composition of the useful load, including the total weight of fuel and oil with tanks full.

(d) Load distribution - All authorized c. g. limits shall be stated. If the available space for loading the airplane is adequately placarded or so arranged that any reasonable distribution of the useful load listed in weight above will not result in a c. g. location outside of the stated limits, this section need not include any other information that the statement of the c.g. limits.

In all other cases this section shall also include adequate information to indicate satisfactory loading combinations which will assure maintaining the c. g. position within approved limits.

(e) Maneuvers - All authorized maneuvers and the appropriate airspeed limitations as well as all unauthorized maneuvers shall be included in accordance with the following:

Normal category - All acrobatic maneuvers, including spins, are unauthorized. If the airplane has been demonstrated to be characteristically incapable of spinning in accordance with § 03.1350-NU, a statement to this effect shall be entered here.

Utility category - All authorized maneuvers demonstrated in the type flight tests shall be listed, together with recommended entry speeds. All other maneuvers are not approved. If the airplane has been demonstrated to be characteristically incapable of spinning in accordance with § 03.1350-NU, a statement to this effect shall be entered here.

Acrobatic category - All approved flight maneuvers demonstrated in the type flight tests shall be included, together with recommended entry speeds.

(f) Flight load factor - The positive limit load factors made good by the airplane structure shall be described here in terms of accelerations.

(g) Flight crew - When a flight crew of more than one is required to operate the airplane safely, the number and functions of the minimum flight crew shall be included.

03.621 Operating procedures. This section shall contain information concerning normal and emergency procedures and other pertinent information peculiar to the airplane's operating characteristics which are necessary to safe operatic

03.622 Performance information. Information relative to the following items of performance shall be included:

(1) The stalling speed, V_{so}, at maximum weight

(2) The stalling speed, V_{s1}, at maximum weight and with landing gear and wing flaps retracted

(3) The take-off distance determined in accordance with § 03.122, including the air speed at the 50-foot height, and the airplane configuration, if pertinent

(4) The landing distance determined in accordance with § 03.124, including the airplane configuration, if pertinent

(5) The steady rate of climb determined in accordance with § 03.123 (a) or (b), as appropriate and (c), including the airspeed, power, and airplane configuration, if pertinent.

The effect of variation in (2) with angle of bank up to 60° shall be included.

The calculated approximate effect of variations in (3), (4), and (5) with altitude and temperature shall be included.

03.7 IDENTIFICATION DATA

03.70 Nameplate. A nameplate shall be securely attached to and located in the pilot compartment which shall contain:

(a) The manufacturer's name and address
(b) Model and serial numbers
(c) Date of manufacture
(d) Type certificate number

03.71 Airworthiness certificate number. The identifying symbols and registration numbers shall be permanently affixed to the airplane structure in compliance with Part 43.102.

CIVIL AERONAUTICS BOARD

WASHINGTON, D. C.

PART 04 CIVIL AIR REGULATIONS AMENDMENT 04-0
Effective: November 9, 1945

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CIVIL AIR REGULATIONS

PART 13.—AIRCRAFT ENGINE AIRWORTHINESS[1]

Effective August 1, 1941

CIVIL
AERONAUTICS BOARD

WASHINGTON, D. C.

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13.1 GENERAL

13.10 Scope. The airworthiness requirements set forth in this Part shall be used as a basis for determining the original eligibility of aircraft engines for use in certificated aircraft or for the issuance of type certificates therefor. Aircraft engines, when manufactured in accordance with, and conforming to, the aircraft engine specifications approved and in effect prior to the effective date of these regulations, of types having satisfactory safety records, will be eligible for use in certificated aircraft if such engines are in condition for safe operation.

13.11 Deviation. Deviation from these requirements may be permitted if it is clearly demonstrated that such deviation meets standards equivalent to or in excess of the requirements of this Part in insuring safe operation.

13.12 Acceptance of Army or Navy requirements. Equivalent requirements of the United States Army or Navy, with respect to airworthiness, may be accepted in lieu of the requirements provided in this Part.

13.13 Inspection. An authorized representative of the Administrator shall be permitted at any time and place to make such inspections and tests as are necessary to determine compliance with the requirements of this Part.

13.2 AIRWORTHINESS REQUIREMENTS

13.20 Design and construction. The engine shall be designed and constructed to function reliably under all flight and atmospheric conditions when properly installed, operated, and maintained in an aircraft.

13.200 Materials. The engine shall be made of materials proved by experience or conclusive tests to be uniformly adequate in quality and strength, and otherwise suitable for the parts in which they are used.

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[1] Civil Aeronautics Manual 13, which may be secured from the Correspondence Section, Civil Aeronautics Administration, Washington, D. C., sets forth, in detail, the Administrator's interpretations and explanations of the requirements of this Part.

13.201 Fire prevention. The engine shall be so designed and constructed, and materials of such quality shall be used, that the probability of the occurrence and spread of fire, because of structural failure, over-heating, or other causes, shall be reduced to a minimum.

13.202 Detail design. The engine shall incorporate only details of design proved by experience or conclusive tests to be reliable and otherwise satisfactory for safe operation.

13.2020 Durability. The wearing surfaces, lubrication system and parts subject to fatigue shall be so designed and constructed that no unsafe condition will develop between overhaul periods when the engine is properly installed, operated and maintained in an aircraft.

13.2021 Vibration. The engine shall be designed and constructed to operate throughout its normal operating range of speeds and powers without excessive stress in the engine parts because of vibration, and without imparting excessive vibration forces to the engine support structure, when the engine is properly installed, operated and maintained in an aircraft with a suitable flight propeller.

13.2022 Fuel and induction system.

(*a*) The fuel system of the engine shall be designed and constructed to supply a satisfactory mixture under all flight and atmospheric conditions, during idling, acceleration, take-off, flight and landing, when the engine is properly installed, operated and maintained in an aircraft.

(*b*) The intake passages of the engine through which air, or fuel in combination with air passes, for combustion purposes, shall be designed and constructed, insofar as possible, to avoid formation of ice deposits in such passages. The engine shall be designed and constructed so as to permit the use of a satisfactory means of ice prevention.

13.2023 Ignition system. All spark ignition engines shall be equipped with (1) a dual ignition system having at least two spark plugs per cylinder and two separate electrical circuits having separate sources of electrical energy, or (2) an ignition system which will function with equal reliability in flight.

13.2024 Lubrication system. The lubrication system of the engine shall be so designed and constructed that the system will function properly in all flight attitudes and atmospheric conditions in which the engine is intended to be used. In wet sump engines, such requirement shall be met when only one-half the maximum oil supply is in the engine. The system shall be so designed and constructed that provision can readily be made for properly cooling the oil.

13.2025 Engine cooling. The engine shall be designed and constructed to provide satisfactory cooling when the engine is properly installed, operated and maintained in an aircraft.

13.2026 Engine and accessory mounting attachments.

(*a*) The mounting attachments and structure of the engine shall have sufficient strength when the engine is properly supported by a suitable engine mount structure, to meet the structural loading conditions of Part 04, and to withstand vibration forces likely to occur.

(*b*) Accessory mounting provisions and drives shall be designed and constructed to provide for the safe operation of the engine with the accessories attached. All essential engine accessories which may require inspection, adjustment, or removal between engine overhauls shall be mounted in such manner that they may be readily inspected, adjusted or removed without disassembly of the engine.

13.21 Block testing. The engine, including at least essential accessories, shall satisfactorily complete block testing as hereinafter provided under power outputs and conditions simulating the most severe flight operations possible when the engine is properly installed, operated and maintained in an aircraft. Separate engines of identical design and construction may be used for the endurance, calibration, and operation tests.

13.210 Testing equipment and personnel. The applicant shall furnish suitable testing equipment and facilities, and competent personnel to conduct the required block tests

13.211 Witnessing of tests. An authorized representative of the Administrator shall witness all block testing sufficiently to ascertain that the information presented in the applicant's test report is substantially correct and complete. Such representative shall witness, in their entirety, the operation test, the calibration test, the tear-down inspections, and at least the last 50 hours of the endurance tests.

13.212 Engine operating conditions and limitations. The engine operating conditions maintained within suitable tolerances or satisfactorily demonstrated during the testing shall determine the operating limitations to be assigned the engine by the Administrator. Such operating limitations shall include those necessary or advisable for safe operation of the engine, and may be placed on the following and any necessary additional items: Power output, crankshaft speed, manifold pressure, spark and mixture settings, fuel and oil grades, and cylinder head, barrel, intake air, and oil inlet temperatures.

13.213 Calibration tests. The engine shall be subjected to such calibration tests as are necessary to establish its power characteristics and the conditions under which it is to be endurance tested. Such tests shall cover, but need not be limited to, the proposed cruising, maximum-except-take-off, and take-off operating conditions.

13.214 Operation tests. The engine shall be operated at various power outputs and speeds throughout the proposed operating range to demonstrate that the engine has satisfactory running and vibration characteristics, and freedom from detonation.

13.215 Endurance tests. The endurance tests shall consist of the following 150 hours of testing on the same engine, in the order stated: (1) 50 hours at maximum-except-take-off power, (2) 50 hours at the most critical cruising conditions, (3) 40 hours at 91 percent take-off power or at least maximum-except-take-off power, and (4) 10 hours at take-off power. Such endurance test shall be conducted in periods of not less than 30 minutes duration.

13.2150 Engine adjustments and parts replacements.

(*a*) External adjustments and replacements of minor parts such as spark plugs, which are normally made in servicing aircraft engines, may be performed at reasonably spaced servicing periods designated in advance by the applicant.

(*b*) Minor internal adjustments and replacements of minor parts, which are normally made during a top overhaul, may be performed during the optional 100-hour tear-down inspection.

(*c*) The tests shall not be considered satisfactory if excessive adjustments or excessive replacements of minor parts are made, unless it is demonstrated that the causes therefor have been remedied.

(*d*) Parts used to replace other parts, except as permitted by subsections (*a*) and (*b*) hereof, shall satisfactorily meet the 150-hour endurance tests; *provided*, that the Administrator may accept other substantially equivalent proof of such parts.

13.2151 Forced stops. A forced stop is any malfunctioning of the engine or its essential accessories which would cause or make advisable an engine stop, including, but not limited to, structural failure, excessive increase in vibration, excessive leaking of fuel, oil, or coolant, or an appreciable decrease in performance not attributable to general wear or change in atmospheric conditions. When a forced stop occurs, appropriate corrective measures shall be taken to insure insofar as possible that similar malfunctioning will not reduce the reliability of the engine in service.

13.216 Optional tear-down inspection. The applicant may, but shall not be required to conduct a tear-down inspection after the completion of the first 100 hours of endurance testing.

13.217 Final tear-down inspection.

(*a*) At the completion of the endurance tests, the engine shall be completely disassembled and a detailed inspection made of the engine parts. Highly stressed parts shall be examined by suitable methods to determine the presence of hidden fatigue cracks. Wear measurements shall be taken and a comparison made of the final condition of parts and their condition prior to the beginning of the endurance tests or their dimensions as shown on the drawings. A conformity

15.1023 The radial load shall be applied to the wheel in the place of the tire and may be distributed over a portion of the tire by allowing the tire to bear in a box of firm earth or sand.

15.1024 The side load shall be applied to the rim of the wheel at its maximum radius and may be distributed over an arc of not more than 30°. In order to insure sufficient strength in the retaining flanges of the rim, all the side load shall be applied to the inner flange in a direction such as to bend it away from the tire. In such case, the load must be increased so that its side component is equal to the load specified in § 15.1021. The wheel shall be restrained only by the axle.

15.103 A main landing gear wheel shall support the required loads before failure.

15.104 Brakes

15.1040 Testing of brakes for certification.

(a) A wheel-brake combination shall demonstrate satisfactory performance during 100 tests simulating the stopping of an airplane at an average deceleration of at least 10 feet per second, from a speed chosen by the applicant. The kinetic energy absorbed per stop shall be computed and the wheel-brake combination shall be certificated for a kinetic energy absorption not in excess of the amount so determined.

(b) To be eligible for use on airplanes certificated in accordance with the transport category requirements of Part 04, a wheel-brake combination shall further demonstrate satisfactory performance during three tests indentical with those specified in paragraph (a) except that the speed shall be increased to obtain a kinetic energy absorption 125% of that determined under that paragraph.

15.1041-T Adaptation of brakes to airplanes - Transport category.

(a) An airplane certificated in accordance with the transport category requirements of Part 04 shall make use of wheel-brake combinations for which the summation of the kinetic energy ratings of the brakes used in the main landing gear is at least equal to:

$K.E. = .0334\,W\,V_s^2$ where :
$K.E.$ = kinetic energy in foot-pounds.
W = the maximum landing weight of the airplane.
V_s = the power-off stalling speed of the airplane in miles per hour at sea level in standard air at maximum landing weight.

(b) The wheel-brake combinations used in such airplane shall have been tested, in determining the kinetic energy absorption under § 15.1040, from a speed lying between 80% and 100% of V_s.

15.1042 Design Brakes shall be free from any undue tendency to lock or jam, and shall be suitably shielded from water, mud, and oil.

15.1043 Static Torque. The maximum available static torque in reverse shall be at least 40% of the forward static torque when both are measured at the same applied pedal force.

15.1044 Adjustment. When necessary to insure satisfactory performance, the brake mechanism shall be equipped with suitable adjustment devices to compensate for disc or lining wear, heat and other normal service effects.

15.1045 Strength. The brake and all of its attachments to the wheel shall be designed with an ultimate strength sufficient to withstand a torque which is 1.6WR/B, where R is the rolling radius of the tire and B is the number of brakes. A static test of the brake and wheel shall demonstrate that the assembly is capable of withstanding a torque which is 80% of the above without yielding to the point of impairing service operation.

15.1046 Test Log. A log of the test runs shall be submitted together with other calculations which are necessary to indicate compliance with the above brake regulations.

15.1047 Identification Data. Each certificated brake shall bear the following identification as prescribed in § 15.042(e): The foot-pounds of kinetic energy for which it is approved.

15.105 The rim contour of a main landing gear wheel shall conform to the Tire and Rim Association's standards or recommendations unless the wheel is to be used in conjunction with a specially constructed tire.

15.106 A landing gear wheel may be equipped with any make or type of tire: Provided, that the tire is a proper fit on the rim of the wheel: And provided, that the tire rating of the Airplane Tire Committee of the Tire and Rim Association is not exceeded.

15.107 Each unit of a certificated model of main landing gear wheel shall bear the following additional identification data as prescribed in § 15.042(e): The maximum static load for which certificated.

15.108 A request for certification of a type or model or series of models of main landing gear wheels shall be supported by the following additional data as prescribed in § 15.0502:

15.1080 A report of the static tests prescribed in § 15.102. The report shall contain complete details of the tests, including records of wheel deflections and photographs of the test setups. The report shall be signed by the person making the tests, and shall be certified to unless the tests were witnessed by an inspector of the Administrator, in which case such inspector shall also sign the report as a witness.

15.11 Seaplane floats.

15.110 Main seaplane floats will be certificated for a maximum gross weight of airplane which will be determined in accordance with the applicable requirements prescribed in Part 04.

15.1100 Certification of a float does not include certification of the structure attaching it to the aircraft. Such structure is classified in accordance with § 15.022(b).

check consisting of a comparison of the parts of the engine tested with the drawings may be required at this time.

(*b*) If any part shows evidence of fatigue or impending failure or is otherwise not in a condition for safe operation, the engine will not be considered satisfactory unless appropriate corrective measures are taken and proven satisfactory by suitable testing; *provided*, that the Administrator may accept other substantially equivalent proof.

13.218 Test report. The applicant shall prepare and submit a suitable report completely covering the required testing of the engine and the tear-down inspections. Such report shall be signed by an authorized representative of the applicant and the authorized representative of the Administrator who witnessed the testing and tear-down inspections.

13.22 Identification plate. A suitable identification plate shall be permanently attached to the engine in a location which will be readily accessible when the engine is installed in an aircraft. Such plate shall contain such pertinent information as may be prescribed by the Administrator.

13.23 Demonstration of compliance. Compliance with the airworthiness requirements of this Part shall be substantiated insofar as practicable by pertinent technical data and inspections. Analyses or additional tests satisfactory to the Administrator shall be made when warranted by unconventional design features or the results of block testing.

TYPE CERTIFICATE

13.3 Type certificate. In order to obtain an aircraft engine type certificate an applicant shall comply with the foregoing and following requirements: [2]

13.30 Data required. In addition to the data required to show compliance with the airworthiness requirements, the applicant for a type certificate shall submit descriptive data adequate for the reproduction of other engines of the same type.

13.31 Changes. When any change in design, construction or operating limitations is made in an engine being manufactured under a type certificate, suitable data describing the change shall be submitted for the approval of the Administrator.

13.310 Major changes. A major change is any change in design, construction, or operating limitations which might have an adverse effect on the reliability or other airworthiness characteristics of an engine. Proof adequate to show that a major change does not have such adverse effect shall be submitted to the Administrator. Engines incorporating major changes shall not be released for service until such changes are approved by the Administrator.

13.311 Minor changes. A minor change is any change not within the definition of a major change. Adequate data describing each minor change shall be made conveniently available, in the manufacturing plant, to a representative of the Administrator at least by the time such change is released for production. The technical data file formally submitted to the Administrator shall be brought up to date insofar as such minor changes are concerned at least every six months.

13.32 Manufacturer's instructions. The holder of a type certificate shall within a reasonable time after receiving such certificate prepare and submit for approval by the Administrator suitable instructions for the installation, operation, servicing, maintenance, repair and overhaul of the type certificated engine model or models. The holder of a type certificate shall make the approved instructions available to persons engaged in the operation, maintenance, repair or overhaul of engines manufactured under such certificate and shall prepare, submit for approval, and make available such revisions to the instructions as are found advisable from service experience.

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[2] For regulations governing issuance of type certificates see Part 02.

CIVIL AIR REGULATIONS

PART 14
AIRCRAFT PROPELLER AIRWORTHINESS

As Amended to July 15, 1942

CIVIL
AERONAUTICS BOARD

WASHINGTON, D. C.

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14.0 General.

14.00 Provision for rating. Pursuant to the provisions of the Civil Aeronautics Act of 1938, as amended, empowering and requiring the Civil Aeronautics Board to prescribe such minimum standards governing the design, materials, workmanship, construction, and performance of propellers as may be required in the interest of safety, and to provide for the rating of aircraft as to airworthiness, the requirements hereinafter set forth shall be used as the minimum standards for establishing such rating for propellers for use in certificated aircraft.

14.01 Scope.

14.010 Airworthiness requisites. To show eligibility of a propeller for certification the propeller shall meet the requirements herein as to design, construction, and testing. The manufacturer shall comply with the requirements by the submission of technical data and by conducting tests with suitable test equipment. The applicable requirements are set forth in §§ 14.1 through 14.4.

14.011 Type certificate. The general requirements for the issuance of a type certificate are set forth in Part 01.* The procedure relative to type certification of propellers is set forth in § 14.5.

*Note—Now in Part 02.

14.012 Production certificate. The requirements for the issuance of a production certificate are set forth in Part 01.*

*Note—Now in Part 02.

14.013 Deviations. When a propeller embodies a feature of design or construction which deviates from the practice in conventional screw propeller types, application shall be made to the Administrator for special rulings covering the feature in question.

14.02 Hubs and blades. Interchangeable propeller hubs and blades are certificated as separate units and the word "propeller" as herein used applies, where applicable, to a propeller hub and to a blade as well as to a complete propeller.

14.03 Testing facilities. A manufacturer submitting a propeller for certification shall conduct all of the tests and supply or arrange for the testing facilities necessary to show compliance with the requirements contained herein. When, in the opinion of the Administrator, adequate and satisfactory methods of testing other than those outlined herein are available, propellers tested by such methods may be eligible for certification.

14.04 Military propellers. A propeller of a type which has passed the regular endurance tests of and is approved by the United States Army Air Corps or the Bureau of Aeronautics, Navy Department, may be certificated in accordance with § 14.3.

14.05 Propeller operation limits. A certificated propeller shall not be operated at a power or propeller shaft speed, or in conjunction with an engine bore, greater than the limits assigned thereto by the Administrator. The Administrator may specify short-time operation in excess of these limits for take-off purposes except that neither the power nor the speed limits will be raised by more than 10 percent without further testing.

14.06 Propeller identification data. A certificated propeller, propeller blade, or propeller hub shall have the following information conspicuously displayed upon it: manufacturer's name; name, model designation, and serial number of the propeller; and maximum power and maximum speed for which certification has been granted. The identification data shall be permanently attached by means of a plate, stamping, engraving, etching, or other such method upon a non-critical surface of the propeller blade or hub. When such data are not visible when the propeller is assembled or installed on an aircraft, they shall also be painted or printed on the propeller blade or hub.

14.07 Previously approved propellers. These regulations supersede the requirements for approval of propellers set forth in previous regulations. However, propellers rated as suitable for use in approved aircraft in accordance with previous requirements may be used in certificated aircraft at the discretion of the Administrator.

14.1 Design requirements.

14.10 Propellers shall be so designed as to operate without excessive vibration or flutter and shall be constructed of materials which are suitable for service conditions.

14.11 The surface of a propeller blade shall be smooth and the blade shall be faired with respect to the thickness and the moments of inertia about the major and minor axes, with no abrupt curvature changes or irregularities along the blade. Critical surfaces of a metal propeller hub shall be machined smooth without tool marks and any change in cross section shall be faired with as large a fillet as possible.

14.12 It is recommended that a propeller be so designed that the weakest portion of the propeller blade or hub may be inspected without disassembly and that excessive wear or a partial failure will precede a serious type of failure.

14.2 Commercial propellers.

14.20 Data required. In the case of a propeller of a type which has not been previously approved by the Army or Navy, and for which the manufacturer desires the certification of the Administrator, the following information shall be submitted:

14.200 (a) Application for type certificate on a form which will be supplied for the purpose by the Administrator.

14.201 (b) A complete set of drawings descriptive of the propeller, which drawings shall be numbered and dated and shall include change letters for each revision. All details of the propeller shall be shown, including the profile and plan form of the blade, the size of blade cross sections at frequent stations, the hub design and the materials of construction. The material shall be specified on the drawings by reference to specification numbers of the Army, Navy, S. A. E., or other recognized standard whenever possible. If the manufacturer refers to his own specification numbers, details of such specifications shall be furnished the Administrator. All drawings shall be folded to a size of approximately 9 by 12 inches, with the title showing. In order to eliminate a possible source of controversy, the Administrator will not accept drawings which may be altered after approval. Blueprints, photostats or the equivalent are acceptable. If certain of the drawings required for a particular propeller are identical with drawings previously submitted and approved in connection with a prior type of propeller made by the same manufacturer, such drawings need not be again submitted.

14.202 (c) A complete parts list in duplicate, showing the drawing number, change letter, and name of each component part of the propeller. The drawing numbers shall be listed in numerical order. When only one or two drawings are submitted for compliance with § 14.201, it is permissible for the manufacturer to submit these drawings in duplicate in which case a parts list is not required.

14.203 (d) A complete log certified to by the person making the test or signed by a witnessing inspector of the Administrator, at the discretion of the Administrator, describing the manufacturer's tests of the propeller in accordance with §§ 14.21 or 14.22, as the case may be. The log shall include a detailed record of the test with dates; names of persons involved; name and model number of engine, or name, model number, and identification mark of the airplane issued by the Administrator of Civil Aeronautics; and hours of testing with corresponding engine speeds. The report shall also include the results of a detailed inspection of the propeller after the test in accordance with § 14.23.

14.204 (e) A stress analysis when required by § 14.210 or when, in the judgment of the Administrator, the design is sufficiently unconventional to require it.

14.21 Tests required for propellers other than fixed pitch wood propellers. A propeller of such type shall be subjected to a 50-hour endurance block test on an internal-combustion engine rigidly mounted and of the same characteristics as the engine or engines in conjunction with which the propeller will be certificated for use, or on another engine acceptable to the Administrator. The test shall be witnessed by an authorized inspector of the Administrator and may be run without a stop or in periods of 5 hours or more each. The cylinder bore of the engine used for the test will determine the maximum bore of the engine with which identical propellers of this type will be certificated for use. The test shall be run at the proposed rated speed of the propeller with the propeller so adjusted as to absorb its proposed rated power. If the engine is not run at full throttle, and horsepower measurements are not possible during the test, manifold pressure readings shall be taken at frequent intervals. A suitable calibration curve shall be used to determine the power absorbed by the propeller during the test. The power rating assigned to the propeller by the Administrator may correspond to the corrected horsepower developed by the engine if the engine used for the test is of the type on which the propeller is to be certificated for use. In the case of a controllable or automatic pitch propeller, the pitch-changing mechanism shall be operated throughout the usable power range at least once for each hour of the test or the equivalent. The engine may be throttled to prevent overspeeding when changing pitch. After such 50 hours of testing, a controllable or automatic pitch propeller shall also be operated at as close to rated power and speed as possible for period of 5 minutes each at various pitch settings, i. e., at 1-degree intervals throughout the operating range when the design so permits. All variations in running characteristics of the propellers shall be recorded.

14.210 A propeller of the above type which, in the opinion of the Administrator, is sufficiently similar to a previously certificated propeller of the same manufacturer may be subjected to a 50-hour flight test in lieu of the test outlined in § 14.21 provided that its airworthiness is demonstrated to the satisfaction of the Administrator by a comparative stress analysis submitted by the manufacturer. The stress analysis shall compare the pertinent aerodynamic, centrifugal, vibration, and torque impulse load differences between the respective propellers by a mathematical comparison, when possible, and by suitable curves plotted with the radius of the propeller as abscissa. Curves descriptive of the fairing of the propellers shall also be included when applicable. Such 50-hour flight test shall be conducted on an engine of equal or greater power and speed than that in conjunction with which the rating is requested. At least 5 hours of the test shall be run at the proposed rated speed of the propeller.

14.211 It is recommended that metal propellers of this type also be tested by suitable methods to determine their natural frequencies within all ranges of major vibrations which are produced by the operation of the engines in conjunction with which such propellers are to be certificated for use. Such frequencies should be determined at all blade angles within the desired operating pitch range of propellers. Data covering these tests should be submitted to the Administrator in the form of curves and tables. The type of frequency should be described and the nodes located for each frequency.

14.22 Tests required for fixed pitch wood propellers. A propeller of such type shall be subjected to a 10-hour endurance block test on an internal-combustion engine, or to a 50-hour flight test. The testing shall be witnessed by an authorized inspector of the Administrator at the discretion of the Administrator. In the case of a block test the entire test shall be run at the proposed rated speed of the propeller. In the case of a flight test at least 5 hours shall be run at the proposed rated speed of the propeller. Such flight test shall be conducted with an engine of equal or greater power and speed than that in conjunction with which the propeller is to be certificated for use.

14.23 Inspection of a tested propeller. As prescribed in § 14.203, the log of the flight or block test shall include the results of a detailed inspection of the propeller after the test. Photographs of any failures or suspected failures shall be included. A propeller which fails during the testing is not eligible for certification unless the failure is of a nature such that the strength of the propeller is not impaired and a minor modification to the propeller will preclude the probability of future failures of the same type. Aluminum-alloy propellers shall be etched at all critical portions and then examined for minute cracks with a magnifying glass. Steel propellers shall be subjected to both a magnetic and visual inspection for signs of failure.

14.230 A failure of a metal propeller is defined as actual breakage, cracking or permanent set of any part of any blade, hub, bolt, lock nut, spline or keyway; slipping of a blade in its clamping socket; seizing or pitting of any bearing; or jamming of an automatic or controllable pitch mechanism. A wood propeller will be deemed to have failed if the tipping pulls or cracks, if a glue joint opens, or if there is any local failure or crushing around the hub or a bolt. Similar considerations will apply to propellers of any patented composition or of other than conventional wood or metal construction.

14.3 Military propellers. In the case of a propeller of a type which has previously been approved by the Army or Navy and for which the manufacturer desires certification by the Administrator, the following data shall be submitted:

(a) An application as described in § 14.200.

(b) A copy of the official Army or Navy endurance test report which was the basis for the military approval, signed by the Army or Navy representative who witnessed the test. It is not necessary for the manufacturer to submit this report when such report has been previously forwarded to the Administrator through official channels. When the report is being prepared by the military agency the Administrator, to expedite approval, may in the interim accept a copy of the official letter of approval of the propeller which letter shall include the military rating, the length of test, and the output and model designation of the test engine.

(c) Drawings as described in § 14.201.

14.4 Modified propellers. When a manufacturer desires the certification by the Administrator of a propeller which embodies only minor modifications of a certificated propeller of the same manufacturer, data shall be submitted as follows:

(a) An application as described in § 14.200.

(b) Drawings as described in § 14.201.

(c) Technical data which demonstrate conclusively that the airworthiness of the modified propeller is at least equal to that of the certificated propeller.

14.5 Procedure relative to type certification.

14.50 General. The procedure and general requirements for the issuance of a type certificate shall be as prescribed in Part 01.*

*Note—Now in Part 02.

14.51 Sealed drawing list. When a type certificate is granted, a drawing list representative of the certificated propeller is impressed with the seal of the Administrator of Civil Aeronautics and is returned to the manufacturer. Sealed copies of the drawings may be used for this purpose in lieu of a drawing list. Inspectors of the Administrator may call for, and must have access to, the sealed drawing list or drawings together with any other pertinent drawings when making an inspection of the manufacturer's plant to determine whether the propellers as built conform to the approved data.

14.52 Major changes. Any major change from the approved drawings must be approved in advance by the Administrator. A change will be deemed major within the meaning of these regulations if it adversely affects the reliability or airworthiness of the propeller. In general, a change will be deemed major when it decreases the airworthiness of a part the failure of which might prevent the aircraft from continuing flight. In all doubtful cases the decision of the Administrator shall establish the category within which a specific change will be included.

14.520 Information accompanying a request for approval of a change to a certificated propeller shall include technical data, including (when necessary) stress analyses and reports of tests sufficient to demonstrate to the satisfaction of the Administrator that the changed propeller is airworthy. The report shall be signed and certified to by the responsible representative of the manufacturer. If the change is to a different blade shank size, engine shaft size, blade airfoil or propeller material, application shall be made for a new type certificate.

14.53 Minor changes. On January 1 and July 1 of each year the holder of a propeller type certificate shall submit, for approval and file, drawings pertaining to all the minor changes made to the propeller during the preceding 6-month period.

14.54 Reductions in diameter. A type certificate may provide for reduction in diameter from that of the propeller tested, provided that no increase in rating is involved. The diameter of a propeller blade may be reduced by cutting off the tip of a blade and fairing the immediate vicinity or by telescoping the outer sections of the blade. The drawings submitted shall show the details of each blade smaller in radius by 6-inch steps, which details may be shown superimposed on a drawing of the original blade.

CIVIL AERONAUTICS BOARD

WASHINGTON, D. C.

CIVIL AIR REGULATIONS

PART 15.—AIRCRAFT EQUIPMENT AIRWORTHINESS

As amended to April 15, 1944

Sec.

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15.80 Equipment items adapted to only one aircraft model.
15.81 Equipment items adapted to any aircraft model by means of detail design changes.

15.0 GENERAL

15.00 Provision for rating. Pursuant to the provisions of the Civil Aeronautics Act of 1938, as amended, empowering and requiring the Civil Aeronautics Board to prescribe such minimum standards governing appliances, including instruments, equipment, apparatus, parts, appurtenances or accessories of whatever description, which are used, or are capable of being or intended to be used, in the navigation, operation, or control of aircraft in flight (including parachutes and communication equipment and any other mechanism installed in or attached to aircraft during flight), as may be required in the interest of safety, and to provide for the rating of aircraft and such appliances as to their airworthiness, the requirements hereinafter set forth shall be used as the minimum standards for establishing such rating of aircraft appliances for use in certificated aircraft.

15.01 Scope of regulations.

15.010 These regulations shall apply to all important items of equipment which are manufactured as complete units and purchased by aircraft manufacturers and operators for use on certificated aircraft, except engines and propellers which are treated separately in Parts 13 and 14 respectively.

15.011 For the purpose of these regulations an item of equipment shall considered important if, by malfunctioning, it can endanger the safety of the aircraft, or the cargo or passengers in the aircraft or persons or property beneath the aircraft.

15.012 Because the development of aircraft specialties is constantly increasing in scope and variety, there undoubtedly will be developed from time to time, important items of equipment for which specific provision is not in these regulations. In such cases the general procedure for certification will be in accordance with these regulations and the manufacturer of the item in question shall apply to the Administrator for special rulings particularly applicable to it.

15.013 The general requirements for the issuance of a type certificate are set forth in Part 02. The procedure relative to type certification is set forth in 15.05.

15.014 The requirements for the issuance of a production certificate are set forth in Part 02.

15.02 Classification of items of equipment.

15.020 In view of the diversity of items of equipment and the variety of their uses, such items are herein grouped in two major classifications dependent upon the certification procedure applicable to the particular item.

15.0200 The certification procedure to be followed is similar for all items and differs only in detail in accordance with the classification within which a particular item lies.

15.0201 The specific installations in certificated aircraft of certificated items of equipment, irrespective of the classification herein used, are subject in all cases to approval by the Administrator.

15.021 It is desirable to certify a series of similar models of an item of equipment under one certification in order to eliminate as much clerical and identification work as possible. This may be done for some types of wheels, position lights, and other items, a series of which are similar in construction and differ only in size and relatively unimportant structural details. This procedure may be applied to any item to which the manufacturer can show the procedure applicable.

15.022 Items of equipment are classified as follows:

(a) Items of such design that they may be installed and used in any type or model of certificated aircraft, and for which type and production certificates, as defined in Part 02, may be issued to manufacturers.

(b) Items of such design that they necessarily vary to suit one or more types or models of certificated aircraft in which they may be used. Type and production certificates will not be issued for such items. They will be specially approved as integral parts of the aircraft in which they are installed.

15.023 Under 15.022 (a) are included items such as the following: landing gear wheels, seaplane floats, excluding wing-tip floats; skis, including pedestals; position lights, landing flares, safety belts, parachutes, certain types of special flight and engine control units, control wheels, certain types of tail wheel knuckles, certain types of self-locking bolts and nuts, and parts of that general character.

15.024 Under 15.022 (b) are included items such as the following: automatic pilots, de-icing equipment, landing gear shock absorber units, autogiro rotor hubs, wing ribs, fuel and oil tanks, engine cowls, wheel streamlines, propeller hub spinners and other special cowling; wing-tip floats, structures attaching seaplane floats to aircraft, special structures attaching skis to aircraft, heating and ventilating systems.

15.03 Factors affecting certification or special approval.

15.030 All items of equipment falling within the meaning of these regulations irrespective of their classification shall:

(a) satisfactorily fulfill the purpose for which they are intended,

(b) be free from undue hazard, both in themselves and in their method of operation,

(c) be constructed of suitable and dependable materials, and

(d) be manufactured and installed in accordance with the Civil Air Regulations so far as those regulations pertain to the particular item.

15.031 Certain of the above-mentioned factors may be demonstrated by drawings and analyses, others by drawings and tests, and others by visual inspection.

15.04 Identification data

15.040 Each type or model of an item of equipment for which certification is requested shall be assigned a model name or model number by the manufacturer such that it may be distinguished from all other types or models of items of equipment.

15.041 Each unit of a certificated or specially approved type or model of equipment item shall be plainly and suitably marked to indicate that it has been certificated or specially approved. The applicable one of the following two methods shall be used to indicate this:

15.0410 (a) If a type certificate has been issued to the manufacturer for the particular item, each unit shall bear the number of this type certificate.

15.0411 (b) If a type certificate has not been issued to the manufacturer for the particular item, each unit shall bear the words "Administrator of Civil Aeronautics Approved" or an abbreviation thereof (A.C.A.A.).

15.042 Each unit of a certificated or specially approved type or model of equipment item shall bear the following indentification data:

(a) manufacturer's name.

(b) model number or model name,

(c) the serial number or data of manufacture of the particular unit, except that parachutes shall bear at least the date of manufacture,

(d) Administrator of Civil Aeronautics Type Certificate (or A.C.A. T.C.) No. ____, or Administrator of Civil Aeronautics Approved (or A.C.A.A.),

(e) such additional information as is specifically provided for in the following regulations.

15.043 The data prescribed in 15.042 shall be displayed in a conspicuous place on the unit and in such a manner that it may not be easily erased, disfigured, or obscured. Any other information may be added by the manufacturer as his discretion.

15.05 Procedure relative to certification or special approval.

15.050 A request for certification or approval of a type or model, or when possible, of a series of similar models of an item of equipment, shall be supported by the data hereinafter specified.

15.0500 A complete set of drawings descriptive of the item. Drawings of small standard commercial parts need not be submitted, but all other drawings applying to the item, including assembly drawings and, when necessary, installation drawings, shall be submitted. The drawings shall contain all dimensions and material specifications of the item. Material shall be specified by reference to a specification number of the Army, Navy, S.A.E., or other such recognized standard whenever possible. If reference is made to material specifications which are not recognized standards, complete details of such specifishall be submitted. Revision blocks on drawings shall designate the revision by letter and shall state the nature of the revision, the date and, when serial numbers are used, the serial number of the first unit manufactured in accordance with the revision. Title blocks on drawings shall contain the date of the original issue of the drawing and the drawing number. All drawings shall be folded to a size approximately 9 x 12 inches with the title block showing. In order to eliminate a possible source of controversy, the Administrator will not accept drawings which may be altered after approval. Blueprints, photostats, or their equivalent are satisfactory. These shall not contain pencil or ink notations. If certain of the drawings required for a particular model are identical with drawings previously submitted and approved in connection with a prior model made by the same manufacturer, such identical drawings need not again be submitted.

15.0501 A list, in duplicate, of all drawings applicable to the item, Such list shall include all drawings previously submitted and approved in connection with prior models made by the same manufacturer. which also apply to the model in question without change. The list shall be arranged in numerical order and shall designate each drawing by number, title, original date of issue, latest revision letter, and the model designation of the item for which the drawing was previously and originally submitted if for other than the model in question. Manufacturers' parts lists, if containing the information specified herein, are acceptable as drawing lists.

PART 15 - AIRCRAFT EQUIPMENT AIRWORTHINESS

15.0502 Such additional data as are hereinafter prescribed for specific cases.

15.0503 The list specified in 15.0501 need not be submitted if the item for which certification is requested is described by only one or two drawings. In such a case, however, the drawings specified in 15.0500 shall be submitted in duplicate.

15.051 If the item falls within the classification covered by 15.022 (a), the data submitted shall include a properly executed formal application for type certificate in accordance with Part 02.

15.52 If the item falls within the classification covered by 15.022 (b), complete information as to the make and model or makes and models of aircraft in which the item is to be installed shall be furnished, together with an application for special approval on a form which will be supplied for the purpose by the Administrator. If specific aircraft are involved, the information to be furnished shall include also the serial numbers and aircraft certificate numbers of the aircraft in question.

15.053 Items of equipment which comply with the regulations herein prescribed to the satisfaction of the Admisistrator may be certificated or approved, as the case may be, for use in certificated aircraft.

15.054 If application for a type certificate has been made, certification is also contingent upon compliance with Part 02 to the satisfaction of the Administrator.

15.055 Certification is subject to the provisions and restricts stated on the type certificate and on the specification for the item issued as part of the type certificate, and approval is subject to the provisions and restrictions stated on the specification issued for the aircraft in which the item is installed.

15.056 All manufactured units of a certificated or approved item of equipment shall be in exact accordance with the approved drawings and specifications.

15.057 Changes or modifications to a certificated or approved item of equipment shall be approved by the Administrator in advance.

15.058 A request for approval of a change or modification to a certificated or approved item of equipment shall be supported by revised or new drawings showing the changes; revised drawing list pages, in duplicate, showing the revised or new drawings; and technical data, including reports of any necessary tests, sufficient to demonstrate to the satisfaction of the Administrator that the changed or modified item is airworthy.

15.06 Previously approved items of equipment. These regulations supersede the requirements for approval of items of equipment set forth in previous regulations. However, items of equipment rated as suitable for use in approved aircraft in accordance with previous requirements may be used in certificated aircraft at the discretion of the Administrator.

15.1 Landing gear equipment.

15.10 Landing gear wheels.

15.100 Main landing gear wheels will be certificated for a maximum static load which will be determined from the strength of the wheel. Tail wheels will not be certificated.

15.1000 For the purpose of these regulations main landing gear wheels are considered as those nearest the airplane center of gravity with respect to fore-and-aft location.

15.1001 For the purpose of these regulations a tail wheel is considered as one which supports the tail of a conventional airplane in the three-point landing attitude.

15.101 For wheels other than main landing or tail wheels, application shall be made to the Administrator for special rulings particularly applicable to the cases in question.

15.102 The strength of a main landing gear wheel shall be substantiated by the following two static tests:

(a) radial load test. (See § 15.1020)
(b) side load test. (See § 15.1021)

15.1020 The required radial test load is equal to -

$$(P)x(n)x(1.5)x(1.15)$$

where P is the maximum static load for which approval is requested, n is

$$2.80 + \frac{9000}{2P+4000}$$

and is the applied landing load factor for the corresponding airplane, 1.5 is the factor of safety, and 1.15 is a strength test material factor.

15.1021 The required side test load is equal to -

(0.35)x(the radial test load).

15.1022 The radial and side loads shall be applied separately and the wheel shall be equipped with the correct size tire inflated to the proper pressure for the load for which certification is requested.

15.1023 The radial load shall be applied to the wheel in the place of the tire and may be distributed over a portion of the tire by allowing the tire to bear in a box of firm earth or sand.

15.1024 The side load shall be applied to the rim of the wheel at its maximum radius and may be distributed over an arc of not more than 30°. In order to insure sufficient strength in the retaining flanges of the rim, all the side load shall be applied to the inner flange in a direction such as to bend it away from the tire. In such case, the load must be increased so that its side component is equal to the load specified in § 15.1021. The wheel shall be restrained only by the axle.

15.103 A main landing gear wheel shall support the required loads before failure.

15.104 Brakes

15.1040 Testing of brakes for certification.

(a) A wheel-brake combination shall demonstrate satisfactory performance during 100 tests simulating the stopping of an airplane at an average deceleration of at least 10 feet per second, from a speed chosen by the applicant. The kinetic energy absorbed per stop shall be computed and the wheel-brake combination shall be certificated for a kinetic energy absorption not in excess of the amount so determined.

(b) To be eligible for use on airplanes certificated in accordance with the transport category requirements of Part 04, a wheel-brake combination shall further demonstrate satisfactory performance during three tests indentical with those specified in paragraph (a) except that the speed shall be increased to obtain a kinetic energy absorption 125% of that determined under that paragraph.

15.1041-T Adaptation of brakes to airplanes - Transport category.

(a) An airplane certificated in accordance with the transport category requirements of Part 04 shall make use of wheel-brake combinations for which the summation of the kinetic energy ratings of the brakes used in the main landing gear is at least equal to:

$K.E. = .0334\ W\ V_s^2$ where : K.E. = kinetic energy in foot-pounds.
W = the maximum landing weight of the airplane.
V_s = the power-off stalling speed of the airplane in miles per hour at sea level in standard air at maximum landing weight.

(b) The wheel-brake combinations used in such airplane shall have been tested, in determining the kinetic energy absorption under § 15.1040, from a speed lying between 80% and 100% of V_s.

15.1042 Design Brakes shall be free from any undue tendency to lock or jam, and shall be suitably shielded from water, mud, and oil.

15.1043 Static Torque. The maximum available static torque in reverse shall be at least 40% of the forward static torque when both are measured at the same applied pedal force.

15.1044 Adjustment. When necessary to insure satisfactory performance, the brake mechanism shall be equipped with suitable adjustment devices to compensate for disc or lining wear, heat and other normal service effects.

15.1045 Strength. The brake and all of its attachments to the wheel shall be designed with an ultimate strength sufficient to withstand a torque which is $1.6WR/B$, where R is the rolling radius of the tire and B is the number of brakes. A static test of the brake and wheel shall demonstrate that the assembly is capable of withstanding a torque which is 80% of the above without yielding to the point of impairing service operation.

15.1046 Test Log. A log of the test runs shall be submitted together with other calculations which are necessary to indicate compliance with the above brake regulations.

15.1047 Identification Data. Each certificated brake shall bear the following identification as prescribed in § 15.042(e): The foot-pounds of kinetic energy for which it is approved.

15.105 The rim contour of a main landing gear wheel shall conform to the Tire and Rim Association's standards or recommendations unless the wheel is to be used in conjunction with a specially constructed tire.

15.106 A landing gear wheel may be equipped with any make or type of tire: Provided, that the tire is a proper fit on the rim of the wheel: And provided, that the tire rating of the Airplane Tire Committee of the Tire and Rim Association is not exceeded.

15.107 Each unit of a certificated model of main landing gear wheel shall bear the following additional identification data as prescribed in § 15.042(e): The maximum static load for which certificated.

15.108 A request for certification of a type or model or series of models of main landing gear wheels shall be supported by the following additional data as prescribed in § 15.0502:

15.1080 A report of the static tests prescribed in § 15.102. The report shall contain complete details of the tests, including records of wheel deflections and photographs of the test setups. The report shall be signed by the person making the tests, and shall be certified to unless the tests were witnessed by an inspector of the Administrator, in which case such inspector shall also sign the report as a witness.

15.11 Seaplane floats.

15.110 Main seaplane floats will be certificated for a maximum gross weight of airplane which will be determined in accordance with the applicable requirements prescribed in Part 04.

15.1100 Certification of a float does not include certification of the structure attaching it to the aircraft. Such structure is classified in accordance with § 15.022(b).

15.1101 The installation of floats on aircraft shall be in accordance with the provisions of Part 04.

15.111 Each unit of a certificated model of main seaplane float shall bear the following additional identification data as prescribed in § 15.042(e):
(a) the maximum gross weight of aircraft for which certificated
(b) the number of floats per aircraft

15.112 A request for certification of a type or model or series of models of main seaplane floats shall be supported by the following additional identification data as prescribed in § 15.0502:

15.1120 The technical data required to prove compliance with the applicable structural and detail design requirements prescribed in Part 04.

15.12 Skis.

15.120 Skis, including ski pedestals, will be certificated for a maximum static load which will be determined from the strength of the ski.

15.1200 Certification of a ski and its pedestal does not include certification of any special structure attaching it to the aircraft. Such structure is classified in accordance with § 15.022(b).

15.1201 The installation of skis on aircraft shall be in accordance with the provisions of Part 04.

15.121 The strength of a ski, including the pedestal, shall be substantiated by a stress analysis or by static tests.

15.122 A ski, including the pedestal, shall be designed to carry the following loads without failure when supported at the pedestal bearing sleeve:

15.1220 A load upward, distributed uniformly along the ski bottom and symmetrically with respect to the pedestal bearing sleeve in the fore-and-aft direction, the front end of the ski carrying no load if it is at a greater distance from the bearing sleeve than the rear end. The required load is equal to -

$$(P)x(n)x(1.5)$$

where P is the maximum static load for which approval is requested, n is

$$2.80 + \frac{9000}{2P+4000}$$

and is the applied landing load factor for the corresponding airplane, and 1.5 is the factor of safety.

If the strength is substantiated by static test, the required test load is equal to -

$$(P)x(n)x(1.5)x(1.15)$$

where 1.15 is a strength test material factor.

15.1221 A load upward, applied to the ski bottom at a point directly under the pedestal bearing sleeve. The required load, or required test load, is equal to the load, or test load, specified in § 15.1220.

15.1222 A side load distributed uniformly along the edge of the ski bottom and symmetrically with respect to the pedestal bearing sleeve in the fore-and-aft direction, the front end of the ski carrying no load if it is at a greater distance from the bearing sleeve than the rear end. The required load, or required test load, is equal to 35% of the load, or test load, specified in § 15.1220. When the height of the aircraft axle from the ground with the ski installed is greater than the moment arm given in Figure 15-1 for the static load for which approval is requested, such side load may be reduced by the ratio of the moment arm given in Figure 15-1 to the height of the axle from the ground with the ski installed. (See page 17 for Figure 15-1)

15.1223 A side load applied to the edge of the ski bottom at a distance forward of the axle equal to three times the pedestal height, except that if the pedestal height is less than the moment arm given in Figure 15-1 for the static load for which approval is requested, then the distance shall be three times the moment arm given in Figure 15-1. This side load shall be one-third the side load specified in § 15.1222. (See page 17 for Figure 15-1)

15.123 Each unit of a certificated model ski shall bear the following additional identification data as prescribed in S 15.042(e):

15.1230 The maximum static load for which certificated.

15.124 A request for certification of a type or model or series of models of skis shall be supported by the following additional data as prescribed in § 15.0502:

15.1240 (a) A stress analysis of the ski and pedestal showing compliance with S 15.122, if the strength of the ski and pedestal has been substantiated by a stress analysis. Such analysis shall be signed by the responsible engineer.

15.1241 (b) A report of the static tests showing compliance with § 15.122 if the strength of the ski and pedestal has been substantiated by static tests. The report shall contain complete load computations, complete details of the tests, and photographs of the test setups. The report shall be signed by the person making the tests and shall be certified to unless the tests were witnessed by an inspector of the Administrator, in which case such inspector also will sign the report as a witness.

15.2 NAVIGATION APPLIANCES

15.20 Position lights.

15.200 General provisions. Position lights prescribed in Part 04 of the Civil Air Regulations, in order to be certificated, shall be so constructed and capable of being so mounted as to comply with the regulations hereinafter prescribed.

15.2000 A request for certification and such supporting data as may be prescribed herein shall be accompanied by a complete set of lights described in the data. Such data shall include a copy of the instruction for the mounting of the lights in aircraft as furnished by the light manufacturer to purchasers.

15.2001 As the forward (right and left) lights are complementary, they will be certificated as a unit. The rear (tail) light will be certificated as a separate unit.

15.2002 Forward lights are classified as follows:
(a) standard forward position lights,
(b) air carrier forward position lights,
(c) auxiliary position lights.

15.201 Light distribution requirements. (See C.A.M. 15 for diagrams)

15.2010 Definitions. Three dihedral angles hereinafter referred to as dihedral angle L, dihedral angle R, and dihedral angle A, are defined as follows: dihedral angle L is formed by the intersection of two vertical planes, one passing through the forward axis of the light unit, as defined in the mounting instructions, and the other at an angle of 110 degrees to the first, measured to the left when looking away from the unit; dihedral angle R is formed by the intersection of two vertical planes, one passing through the forward axis of the light unit, as defined in the mounting instructions, and the other at an angle of 110 degrees to the first, measured to the right when looking away from the unit; and dihedral angle A (aft) is formed by the intersection of two vertical planes making dihedral angles of 70 degrees to the left and 70 degrees to the right, respectively, of a vertical plane passing through the rear axis of the light unit, as defined in the mounting instructions. Each dihedral angle shall be understood to include the bounding planes as well as the space between the planes.

15.2011 Standard forward position lights. Each standard forward position light shall have an intensity of not less than 3 candles in all directions in dihedral angle L for the left light and dihedral angle R for the right light. Within these dihedral angles, respectively, the intensity in all directions shall equal or exceed the minimum values given in Table I according to the angle between the direction of measurement and the forward axis of the unit.

TABLE I

Minimum permissible intensities in any plane through the forward axis of the unit

At angles from forward axis not exceeding	Intensity
60 degrees	4 candles
30 degrees	8 candles

In all directions in dihedral angle R for the left light and in dihedral angle L for the right light, a tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to not over 2 candles. In these same directions a further tolerance of an additional 10 degrees will be allowed in which the intensity shall be reduced to not more than 0.5 candle. In all directions in dihedral angle A a tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to a maximum intensity of 0.5 candle. In all directions outside the specified dihedral angle and the allowed tolerance angles for each unit, the stray light intensity shall not exceed 0.5 candle.

15.2012 Air Carrier forward position lights. Each air carrier forward position light shall have an intensity of not less than 3 candles in all directions in dihedral angle L for the left light and in dihedral angle R for the right light. Within these dihedral angles, respectively, the intensity in all directions shall equal or exceed the minimum values given in Table II according to the angle between the direction of measurement and the forward axis of the unit.

TABLE II

Minimum permissible intensities in any plane through the forward axis of the unit

At angles from forward axis not exceeding	Intensity
60 degrees	5 candles
30 degrees	10 candles
20 degrees	20 candles
15 degrees	30 candles
10 degrees	35 candles
5 degrees	40 candles

Within the same dihedral angles the intensities in the horizontal plane shall equal or exceed the minimum values given in Table III according to the angle between the direction of measurement and the forward axis of the unit.

TABLE III

Minimum permissible intensities in the horizontal plane through the forward axis of the unit

At angles from forward axis not exceeding	Intensity
80 degrees	5 candles
40 degrees	10 candles
30 degrees	20 candles
20 degrees	30 candles
10 degrees	40 candles

In all directions in dihedral angle R for the left light and in dihedral angle L for the right light, a tolerance of 10 degrees will be allowed in which the intensity of those lights shall be reduced to not over 10 candles. In these same directions a further tolerance of an additional 10 degrees will be allowed in which the intensity shall be reduced to not more than 1 candle. In all directions in dihedral angle A a tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to not more than 1 candle. In all directions outside the specified dihedral angle and the allowed tolerance angles for each unit, the stray light intensity shall not exceed 1 candle.

15.2013 Auxiliary forward position lights. Each auxiliary forward position light shall have an intensity of not less than 20 candles in all directions not exceeding 30 degrees of the forward axis of the unit, measured in dihedral angle L for the left unit and in dihedral angle R for the right unit. Within the afore-described angles the intensity in all directions shall equal or exceed the mimimum values given in Table IV according to the angle between the direction of the measurement and the forward axis of the unit.

TABLE IV

Minimum permissible intensities in any plane through the forward axis of the unit

At angles from forward axis not exceeding	Intensity
20 degrees	30 candles
10 degrees	40 candles

In all directions in dihedral angle R for the left light and in dihedral angle L for the right light, a tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to not over 8 candles. In these same directions a further tolerance of an additional 10 degrees will be allowed in which the intensity shall be reduced to not more than 0.5 candle. In all directions in dihedral angle A the maximum intensity shall be less than 0.5 candle.

15.2014 Non-air carrier airplane rear position lights. Each rear position light shall have an intensity of not less than 4 candles in dihedral angle A. Within this dihedral angle the intensity in all directions not exceeding 70 degrees from the rear axis of the unit, shall be not less than 8 candles. In all directions in dihedral angle L and in dihedral angle R, a tolerance of 20 degrees will be allowed in which the intensity of this light must be reduced to a maximum stray light intensity of 1 candle. In all directions outside the specified dihedral angle and the allowed tolerance angles, the stray light intensity shall not exceed 1 candle.

15.2015 Air carrier airplane rear position lights. Air carrier airplane rear position lights shall emit an alternate aviation red and aviation white flash repeated at a frequency of 40 cycles a minute; each cycle shall have the following characteristics: 150 degrees white - 10 degrees dark -- 150 degrees red - 50 degrees dark. A tolerance of plus or minus 10% will be allowed in the above figures. Both white and red lights shall be fitted with 32 candlepower lamps. The red and white units of the light may be separate units spaced as closely as possible. Each color of light shall be completely visible in dihedral angle A. If separate red and white units are used, certificated white tail lights may be converted into such units as follows: (a) the candlepower of the lamps shall conform to the requirements of this section, (b) the clear cover glass for the intended red unit shall be replaced by a red cover glass of the same design. No photometric tests of such converted lights will be considered necessary when the above changes are made. If the light is of a new type, it shall emit light in all directions in dihedral angle as specified in § 15.2014.

15.202 Color. All left forward position lights shall be aviation red, all right forward position lights shall be aviation green, and all rear position lights for non-air carrier aircraft shall be aviation white. These colors are defined as follows:

(a) Aviation red is a color having the following ICI chromaticity coordinates:

y is not greater than 0.335 and
z is not greater than 0.002;

(b) Aviation green is a color having the following ICI chromaticity coordinates:

x is not greater than $0.440 - 0.320y$
x is not greater than $y - 0.170$ and
y is not less than $0.390 - 0.170x$;

(c) Aviation white is a color having the following ICI chromaticity coordinates:

x is not less than 0.350
x is not greater than 0.540
$y - y_o$ is not numerically greater than 0.01
y_o being the y coordinate of the Planckian radiator for which $x_o = x$.

15.203 Light covers. The lamp and reflectors shall be protected by a cover which shall be of noncombustible material and so constructed that it will not change color or shape, or cloud, or suffer any considerable loss of transmission in normal use. The coloring of those portions which are intended to transmit light shall be completely diffused through the material.

15.21 Landing flares.

15.210 Landing flares prescribed in Part 04, in order to be certificated, shall be so constructed and capable of being so mounted as to comply with the regulations hereinafter prescribed.

15.2100 The installation of landing flares in aircraft shall be in accordance with the provisions of Part 04 and the flare manufacturer's mounting instructions.

15.211 Landing flares will be certificated with respect to their light duration and light intensity. They are grouped in three classifications as follows:

(a) class 1 flares,
(b) class 2 flares,
(c) class 3 flares.

15.212 Class 1 flares shall have a light duration of at least 3 minutes, a light intensity of at least 200,000 candlepower, and a rate of descent not greater than 550 feet per minute.

15.213 Class 2 flares shall have a light duration of at least $1\frac{1}{2}$ minutes, a light intensity of at least 110,000 candlepower, and a rate of descent not greater than 550 feet per minute.

15.214 Class 3 flares shall have a light duration of a least 1 minute, a light intensity of at least 70,000 candlepower and a rate of descent not greater than 550 feet per minute.

15.215 Each unit of a certificated model landing flare shall bear the following additional identification data as prescribed in § 15.042 (e):

15.2150 The class for which certificated.

15.217 Upon satisfactory completion of the examination of the technical data submitted to the Administrator, five flares of each model described in the data, an airplane arranged for the complete installation of flares of each model, and operation personnel shall be made available for functional tests of the flares. These tests may be made at any location desired by the manufacturer.

15.2170 In the event that there is one failure out of the 5 flares subjected to functional tests, 5 additional flares shall be subjected to functional tests.

15.2171 Failure of two or more flares out of 10 dropped shall be sufficient grounds for denial of certification by the Administrator. Certification will be made only if all 5 original flares function satisfactorily, or, in the event of one failure in the original 5, if the second 5 function satisfactorily.

15.3 SAFETY EQUIPMENT

15.30 Safety belts.

15.300 Safety belts will be certificated for general aircraft use or for glider use dependent upon the strength of the belt.

15.3000 Certification of a safety belt does not include certification of its anchorages to the aircraft.

15.3001 The installation of safety belts in certificated aircraft shall be in accordance with the pertinent provisions of Part 04.

15.301 Safety belts shall be so designed as to be easily adjustable. Each belt shall be equipped with a quick-release mechanism so designed that it cannot be released inadvertently. The width of a certificated safety belt shall be at least 2 inches.

15.302 The strength of a safety belt shall be determined by static test.

15.303 Safety belts for general aircraft use will be certificated for one person or two adjacent persons dependent upon the strength of the belt.

15.3030 A safety belt for one person shall be capable of withstanding a load of 2,000 pounds applied in the same manner as the weight of two persons would be applied in a crash. The quick-release mechanism shall be capable of withstanding this load without undue distortion, and when the load is relieved to 800 pounds, the mechanism shall be capable of being operated by hand.

15.304 Safety belts for glider use only will be certificated as such.

15.3040 A safety belt for glider use shall be capable of withstanding a load of 850 pounds applied in the same manner as a person's weight would be applied in a crash. The quick-release mechanism shall be capable of withstanding this load without undue distortion, and when the load is relieved to 400 pounds, the mechanism shall be capable of being operated by hand.

15.305 Each unit of a certificated model safety belt shall bear the following additional identification data as prescribed in § 15.042 (e):

15.3050 Whether for one person, two persons, or for glider use only,

15.306 A request for certification of a type or model or series of models of safety belts shall be supported by the following additional data as prescribed in § 15.0502:

A report of the static tests showing compliance with § 15.3030, 15.3031, or 15.3040, as the case may be. The report shall contain complete details of the tests, including the hand operation of the quick-release mechanism under relieved load, and shall contain photographs of the test setup. The report shall be signed by the person making the tests and shall be certified to unless the tests were witnessed by an inspector of the Administrator in which case such inspector also will sign the report as a witness.

15.31 Parachutes.

15.310 Parachutes prescribed by the Civil Air Regulations, in order to be certificated, shall be so constructed as to comply with the following regulations.

15.3100 All materials used shall be equivalent to or better than those specified by the United States Army or Navy for parachutes, or shall be proved satisfactory to the Administrator by technical data and practical tests.

15.3101 The follow-through between parachute and rider shall be so engineered that all parts or fittings carrying a shock load are stronger than the combined strength of the suspension lines to which they are attached.

15.3102 All metal parts shall be designed to carry their full rated load without yielding.

15.3103 The fabric used in the canopy construction shall be free from gums, starches, and other foreign material. It shall also be free from avoidable imperfections in manufacture and from defects or blemishes affecting its strength or durability and shall have been finished without application of excessive heat. The surface of the fabric shall be smooth.

15.3104 Suspension lines shall be continuous, without splices, from connector link to connector link and shall contain no knots between these points.

15.3105 Before securing the suspension lines to the skirt, each line shall be put under 40 pounds tension and marked to show the point of attachment. The fabric shall be pulled out but not stretched.

15.3106 The machine sewing shall be made with a shuttle or plain stitch. All zigzag sewing shall be done on a 2-stitch sewing machine.

15.3107 The rip cord, including joints between the handle and the release, shall be designed to withstand a load of 300 pounds.

15.3108 The harness shall be so contructed that the rider can release himself and drop clear in case of a water landing, but a quick-attachable or quick-releasing device between the harness and the parachute is not mandatory.

15.3109 Each parachute outfit shall be provided with a suitable place for keeping a record card containing spaces for recording dates of repacking, repairs, by whom made, and space for the manufacturer's recommendations as to repacking.

15.311 Deviations from § 15.3104, 15.3105, and 15.3106 shall be such as are acceptable to the United States Army or Navy, or shall be proved satisfactory to the Administrator by technical data and practical tests.

15.312 A request for certification of a type or model or series of models of parachutes shall be supported by the following additional data as prescribed in § 15.0502:

15.3120 (a) Data showing compliance with § 15.3100 to 15.3109 inclusive. These data may be references to drawings submitted if the drawings clearly show compliance with these regulations.

15.3121 (b) Data substantiating any deviations in accordance with § 15.311

15.3122 (c) A detailed list of the material and strength specifications of all component parts of the parachutes described in the drawings. The list shall also specify the manufacturing practices employed in the assembly operations and shall satisfy the Administrator that all parts are properly pull-tested before assembly.

15.313 Upon satisfactory completion of the examination of the technical data submitted to the Administrator of Civil Aeronautics, parachutes of each model described in the data together with an airplane and operating personnel shall be made available for the following tests of the parachutes. These tests may be made at any location desired by the manufacturer.

15.3130 Functional test (Normal pack). 12 drops from an airplane with a 170-pound dummy man from an altitude of not more than 500 feet. The indicated air speed of the airplane at the time of release shall be 70 miles per hour. No twists shall purposely be packed in the suspension lines. The parachute must be fully open within 3 seconds from time of release.

15.3131 Functional test (Twisted lines). 5 drops from an airplane with a 170-pound dummy man from an altitude of not more than 500 feet. The indicated air speed of the airplane at the time of release shall be 70 miles per hour. 3 twists shall purposely be packed in the suspension lines near the skirt. The parachute must be fully open within 4 seconds from time of release.

15.3132 Strength test. 3 drops with the same parachute from an airplane with a 600-pound lead weight from an altitude of not more than 500 feet. The indicated air speed of the airplane at the time of release shall be 100 miles per hour. No twists shall purposely be packed in the suspension lines. The weight shall be attached to the harness. No external shock absorbers or weight shall be attached to the harness. No external shock absorbers or material which may act as such shall be permitted. The parachute shall show no failure of any material.

15.3133 Live drop tests. 2 live drops from an airplane with a 170-pound man from an altitude of 2,000 feet on a comparatively still day. An additional certificated auxiliary parachute shall be carried. The rider must suffer no discomfort from opening shock and must be able to disengage himself from the harness after landing.

15.314 Rate of descent test. One drop from an airplane with a 170-pound dummy man from an altitude of 2,500 feet. The rate of descent shall not exceed

21 feet per second. The descent shall be timed from the time of full opening to the time of ground impact. The distance descended shall be assumed at 2,250 feet and the rate of descent shall be this distance divided by the time in seconds.

15.3135 100 percent performance shall be required in the tests specified in § 15.3130 through 15.3134 except in the case of an auxiliary parachute. (See § 15.315))

15.314 The tests specified in § 15.313 will not be required for parachutes previously approved by the United States Army Air Corps or by the Bureau of Aeronautics, Navy Department. In lieu of these tests, there shall be included in the supporting data submitted with a request for certification of such a parachute the following data:

15.3140 (a) A copy of the official report describing the drop tests and static tests which formed the basis of the Army or Navy approval, signed by the Army or Navy representatives who witnessed the tests.

15.3141 (b) A statement by an authorized representative of the Army or Navy to the effect that the parachute is approved and accepted by the Army or Navy as the case may be.

15.315 A parachute to be certificated for use as an auxiliary parachute in combination with a certificated parachute need not comply with the rate of descent specified in § 15.3134 but shall have a rate of descent not exceeding 25 feet per second and shall comply with all of the other regulations herein prescribed.

15.3150 The technical data submitted in connection with an auxiliary parachute and the tests made to obtain its certification shall satisfactorily account for the combination of parachutes and not the auxiliary parachute alone.

15.3151 Each unit of a certificated model auxiliary parachute shall bear the following additional identification data as prescribed in § 15.042 (e): "Auxiliary only."

15.4 CONTROL AND STRUCTURAL UNITS

15.40 General.

15.400 Certain types of special units and structural units, such as those listed in § 15.023, so designed that they can be used in any type or model of aircraft without change or with only minor changes which in no way affect the operation or strength of the units, will be certificated provided that they comply with the regulations applicable to them prescribed in Part 04.

15.4000 The installation of such special units in aircraft shall be in accordance with the pertinent provisions of Part 04 and the instructions of the manufacturers of the units.

15.401 Before requesting certification of a type or model or series of models of a special control unit or structural unit, the manufacturer shall apply to the Administrator for a ruling as to the additional data to be submitted in accordance with § 15.0502 to show compliance with the regulations applicable to the unit in question prescribed in Part 04. This application shall be accompanied by a description of the unit and a drawing, or drawings, sufficient to enable the Administrator to make a ruling particularly applicable to the unit in question.

15.8 EQUIPMENT ITEMS ADAPTED TO SPECIFIC AIRCRAFT MODELS

15.80 Equipment items adapted to only one aircraft model.

15.800 Certain items of equipment, such as those listed in § 15.024, so designed that they can be used only in one aircraft model will be specially approved as integral parts of the aircraft in which they are installed provided that they comply with the regulations applicable to them prescribed in Part 04.

15.801 A request for approval of such an item of equipment shall be supported by the following additional data as prescribed in § 15.0502.
15.8010 (a
15.8010 (a) Data showing compliance with the regulations applicable to the item in question prescribed in Part 04:

15.8011 (b) In lieu of the data specified in § 15.801 (a), data in accordance with a special ruling made by the Administrator and obtained by the procedure prescribed in § 15.401.

15.802 The request for approval of such an item of equipment together with its supporting data shall be included with the approval request and supporting data for the aircraft model in which the item is installed.

15.81 Equipment items adapted to any aircraft model by means of detail design changes.

15.810 Certain items of equipment, such as those listed in S 15.024, of such a nature that by means of detail design changes they can be used in any aircraft model, will be specially approved as integral parts of the aircraft in which they are installed provided that they comply with the regulations applicable to them prescribed in Part 04.

15.811 If the manufacturer so desires, such an item of equipment may be considered as a series of items, each so designed that it can be used only in one aircraft model. Approval in such a case will be handled as prescribed in § 15.80.

15.812 If the procedure prescribed in § 15.811 is too cumbersome to suit a particular item, the item will be considered in two parts as follows:
(a) the unchanged basic structure
(b) the variable structure

15.813 If the basic structure is deemed satisfactory by the Administrator, only the variable structure need be considered in connection with the certification of each aircraft model in which the item is installed.

15.814 A request for examination of the basic structure of such an item of equipment shall be supported by the following additional data as prescribed in § 15.0502:

15.8140 (a) Data showing compliance with the regulations applicable to the item in question prescribed in Part 04;

15.8141 (b) In lieu of the data specified in S 15.8140 (a), data in accordance with a special ruling made by the Administrator and obtained by the procedure prescribed in S 15.401.

15.815 A request for approval of a complete item of equipment in this classification shall be supported by the following data:

15.8150 (a) Complete references to the data pertaining to the basic structure previously deemed satisfactory by the Administrator;

15.8151 (b) Data as prescribed in § 15.8140 (a) or 15.8141 (b), but pertaining only to the variable structure;

15.8152 (c) Any additional data which may have been prescribed by the Administrator at the time of his examination of the basic structure.

CIVIL AIR REGULATIONS

PART 18—MAINTENANCE, REPAIR, AND ALTERATION OF CERTIFICATED AIRCRAFT AND OF AIRCRAFT ENGINES, PROPELLERS, AND INSTRUMENTS[1]

As Amended to September 1, 1942

CIVIL AERONAUTICS BOARD

WASHINGTON, D. C.

Sec.
18.1 General.
18.2 Routine maintenance.
18.3 Repairs.
18.4 Alterations.
18.5 Rules and procedures for maintenance, repairs, and alterations.
18.6 Design, techniques, and materials.

18.1 General.

18.10 Definitions.

As used in this Part:

(1) "Aircraft engine" means an aircraft engine approved by the Administrator.

(2) "Propeller" means a propeller approved by the Administrator.

(3) "Instrument" means an instrument installed, for other than purely experimental purposes, in a certificated aircraft.

(4) "Manufacturer" means (1) the holder of the type certificate, or approval by the Administrator, for an aircraft, aircraft engine, or propeller, or of the current rights, under a licensing arrangement, to the benefits of such type certificate or approval; or (2) the manufacturer of a part or accessory of a certificated aircraft; or (3) the manufacturer of an instrument which is installed in a certificated aircraft: *Provided*, That such manufacturer shall have in his employ a properly certificated mechanic in direct charge of maintenance, repair or alteration operations.

18.2 Routine maintenance. Routine maintenance is defined as simple or minor preservation operations including but not limited to the adjustment of rigging and clearances, and the replacement of small standard parts not involving complex assembly operations.

18.3 Repairs. A repair is any operation other than routine maintenance which is required to restore an aircraft, aircraft engine, propeller, or instrument to a condition for safe operation, including the mending or replacement of damaged or deteriorated parts.

18.30 Minor repairs. Minor repairs are elementary repair operations executed in accordance with standard practices and not within the definition of major repairs.

18.31 Major repairs. Major repairs are complex repair operations of vital importance to the airworthiness of an aircraft, including but not limited to:

(a) Straightening, splicing, welding and similar operations, when the strength of important structural members might be appreciably affected thereby.

(b) Operations requiring complicated or unconventional techniques or equipment.

18.4 Alterations. An alteration is any appreciable change in the design of an aircraft, aircraft engine, propeller, or instrument.

18.40 Minor alterations. A minor alteration is:

(a) An alteration having no appreciable effect on the weight, balance, structural strength, power-plant operation, flight characteristics or other characteristics affecting the airworthiness of an aircraft; or

(b) An alteration for which specific plans and instructions have been approved by the Administrator and which can be executed by means of elementary operations.

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[1] Civil Aeronautics Manual 18 describes in detail the operations which the Administrator of Civil Aeronautics considers to be routine maintenance, minor and major repairs, and minor and major alterations. It sets forth in detail repair methods, techniques, and practices which the Administrator has found acceptable in the execution of repairs in accordance with these regulations. It also describes forms, scope of technical data, and records prescribed by the Administrator in accordance with this Part.

18.41 Major alterations. Major alterations are all alterations not within the definition of minor alterations.

18.5 Rules and procedures for maintenance, repairs and alterations.

18.50 Agencies authorized to perform maintenance, repair and alteration operations. Maintenance, repair, and alteration operations shall be performed only by: (1) A certificated mechanic having the proper rating or a person working under the direct supervision of such mechanic; or (2) a certificated repair station having the proper rating; or (3) the manufacturer of the aircraft or part of the aircraft to be repaired. *Provided,* That all instrument repairs and alterations and propeller major repairs and major alterations shall be performed only by a certificated repair station having the proper rating or by the instrument or propeller manufacturer.

18.51 Provision for approval of major repairs and major alterations. No aircraft, aircraft engine, or propeller which has undergone any major repair or major alteration shall be returned to service until examined, inspected and approved by a duly authorized representative for the Administrator unless such repair or alteration has been executed in accordance with a manual or specification approved by the Administrator [2] and performed by a certificated repair station of the proper rating or by the manufacturer.

18.52 Flight tests. When an aircraft or aircraft engine or propeller thereof has undergone a maintenance, minor repair or minor alteration operation which may have changed its flight characteristics appreciably or substantially affected its operation in flight, or has undergone a major repair or major alteration, such aircraft shall, prior to carrying passengers, be test-flown by a pilot having at least 200 solo hours and holding at least a private pilot certificate and appropriate rating for the aircraft to be test-flown.

18.53 Recording of repairs and alterations.

18.530 Minor repair and minor alteration log-book entries. An adequate description of every minor repair or minor alteration of an aircraft, aircraft engine, or propeller shall be entered in the appropriate log book over the signature and certificate number of the mechanic directly in charge of or performing such repair or alteration and in case a manufacturer or a certificated repair station makes said repair or alteration the appropriate log book shall also be signed by an authorized official of such agency. The installation of an instrument in an aircraft shall be recorded in the aircraft log book by the agency making the installation.

18.531 Major repair and major alteration records. A repair agency performing a major repair or major alteration on an aircraft, aircraft engine, or propeller, shall execute such Repair and Alteration Forms as may be prescribed and furnished by the Administrator, and shall deliver a duplicate copy of any such Form to the owner of the aircraft and make proper entries on the appropriate page of the Aircraft Operation Record.

18.532 Provision for air carrier records. Log-book and Aircraft Operation Record entries required in this Part may be replaced, in the case of repairs or alterations to scheduled air carrier aircraft, by a suitable system of recording repairs, alterations and signatures of responsible personnel.

18.6 Design, techniques, and materials. Repairs shall be so executed and materials of such strength and quality shall be used that the condition of the repaired aircraft, aircraft engine, propeller, or instrument shall be at least equivalent to its original or a properly altered condition in regard to aerodynamic and mechanical function, structural strength, and resistance to vibration and deterioration, and all other qualities affecting airworthiness. Alterations shall be so designed and executed that the altered aircraft, aircraft engine, propeller, or instrument will comply with the airworthiness requirements in effect when the particular model of the aircraft or part of the aircraft was originally certificated and, in addition, with particular provisions of the current airworthiness requirements rendered necessary for safe operation by the alteration.

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[2] Such manual or specification may, for example, be issued by the manufacturer, a certificated repair station, or by the Administrator. All such manuals or specifications issued by parties other than the Administrator must be approved by him.

CIVIL AIR REGULATIONS

PART 24—MECHANIC CERTIFICATES

As amended to July 1, 1943

CIVIL AERONAUTICS BOARD

WASHINGTON, D. C.

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24.11 Character.
24.12 Citizenship.
24.13 Education.
24.14 Other requirements.
24.2 Mechanic ratings.
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24.36 Reexamination.
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24.4 Examinations and tests.
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24.41 Time and place.
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24.43 Standard of performance.
24.5 Mechanic regulations.
24.50 Airman Rating Record requirement.
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24.52 Major and minor parachute repairs.
24.53 Factory mechanic rating limitations.
24.54 Mechanic identification cards.
24.55 Recent experience requirements.
24.56 Reports.
24.57 Expired certificates: special issuance.

24.1 Mechanic certificate requirements. To be eligible for a mechanic certificate, an applicant shall comply with the following requirements:

24.10 Age. Applicant shall be at least 18 years of age.

24.11 Character. Applicant shall be of good moral character.

24.12 Citizenship. Applicant shall be:

(a) A citizen of and of unquestionable loyalty to the United States, or

(b) A person who is in sympathy with the objectives of the United States and who is a trustworthy citizen of a friendly foreign government not under the domination of or associated with any government with which the United States is at war.

24.13 Education. Applicant shall be able to read, write, speak, and understand the English language: *Provided, however,* That this requirement shall not apply to an applicant employed by an air carrier outside the United States, and that Airmen Rating Records issued to such applicants as may be unable to read, write, speak, or understand the English language shall bear the following notation: "Valid only outside the United States while employed by an air carrier."

24.14 Other requirements. Applicant shall comply with the requirements prescribed in this Part for the particular mechanic rating sought.

24.2 Mechanic ratings. Mechanic ratings are as follows:

(a) Aircraft mechanic rating;
(b) Aircraft engine mechanic rating;
(c) Factory mechanic rating.

24.20 Aircraft mechanic rating. To be eligible for an aircraft mechanic rating, an applicant shall comply with the following requirements:

24.200 Aeronautical knowledge. Applicant shall have theoretical and practical knowledge of aircraft structure and rigging, including the control systems, and aircraft appliances, shall know how properly to inspect, maintain, and repair the same, and shall be generally familiar with the provisions of Parts 04 and 15, and throughly familiar with the provisions of section 60.32, the provisions of Part 01 dealing with aircraft airworthiness, and the provisions of Parts 18 and 24.

24.201 Aeronautical experience. Applicant shall have had at least 1 year of practical experience, or what is deemed by the Administrator to be its equivalent, in the construction, inspection, maintenance, or repair of aircraft and aircraft appliances.

24.202 Aeronautical skill. Applicant shall satisfactorily demonstrate, by means of written, oral, and practical tests, his ability with respect to the subject matters prescribed in §24.200.

24.21 Aircraft engine mechanic rating. To be eligible for an aircraft engine mechanic rating, an applicant shall comply with the following requirements:

24.210 Aeronautical knowledge. Applicant shall have theoretical and practical knowledge of aircraft power plants, propellers, and their appliances, shall know how properly to inspect, maintain, and repair the same, and shall be generally familiar with the provisions of Parts 04, 13, and 14, and thoroughly familiar with the provisions of Part 01 dealing with aircraft airworthiness and the provisions of Parts 18 and 24.

24.211 Aeronautical experience. Applicant shall have had at least 1 year of practical experience, or what is deemed by the Administrator to be its equivalent, in the construction, inspection, maintenance, or repair of aircraft engines, propellers, and their appliances.

24.212 Aeronautical skill. Applicant shall satisfactorily demonstrate, by means of written, oral, and practical tests, his ability with respect to the subject matters prescribed in §24.210.

24.22 (Unassigned).

24.23 Factory mechanic rating. To be eligible for a factory mechanic rating, applicant must be employed by and designated by a manufacturer holding a currently effective production certificate, as in direct charge of the inspection, maintenance, overhaul, or repair of aircraft, aircraft engines, propellers, or instruments constructed by such manufacturer. The experience and employment record of the applicant must indicate that he is competent to engage in such activity.

24.3 Mechanic certificate.

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24.30 Application. Application for a mechanic certificate shall be made upon the applicable form prescribed and furnished by the Administrator.

24.300 Application to amend. When any change in an Airman Rating Record* is desired, the applicant shall file a written request therefor upon the applicable form prescribed and furnished by the Administrator.

24.31 Display. A mechanic certificate shall be kept readily available to the mechanic at all times when he is serving in connection with certificated aircraft, aircraft engines, propellers, appliances, or parachutes and shall be presented for inspection upon the reasonable request of any person.

24.32 Duration. A mechanic's certificate shall be of 60 days' duration, and unless the holder is otherwise notified by the Administrator within such period, it shall continue in effect thereafter until otherwise specified by the Board, unless suspended or revoked: *Provided,* That a factory mechanic's rating shall terminate at any time that the holder thereof ceases to be employed by the manuafcturer to whose products the rating is limited or whenever the facilities of such manufacturer are no longer available to or in use by the holder.

24.33 (Unassigned).

24.34 Non-transferability. A mechanic certificate is not transferable.

24.35 Surrender. Upon the suspension, revocation, or expiration of a mechanic certificate, the holder thereof shall surrender such certificate, upon request, to any officer or employee of the administration.

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* Under § 24.50 no certificated mechanic who is directly in charge of packing parachutes or of the inspection, maintenance, or repair of certificated aircraft, aircraft engines, or their appliances, shall engage in such service unless the appropriate Airman Rating Record is attached to his certificate. The Airman Rating Record is a sheet attached to all mechanic certificates when they are issued and will contain the mechanic rating(s) held by the certificate holder.

24.36 Reexamination. An applicant for a mechanic certificate or rating who has failed any prescribed practical or theoretical examination or test may apply for reexamination at any time after the expiration of 30 days from the date of such failure: *Provided,* That an applicant who has failed only the examination on the pertinent Civil Air Regulations may apply for reexamination on the Civil Air Regulations after he has received not less than 5 hours instruction on the Civil Air Regulations from a certificated ground instructor and presents a statement from such instructor showing the amount of instruction given and stating that he deems the applicant qualified to pass the required examination.

24.37 (Unassigned).

24.38 Revocation. No person whose mechanic certificate has been revoked shall apply for or be issued a mechanic certificate of any rating for a period of one year after the revocation, except as the order of the revocation may otherwise provide.

24.4 Examinations and tests.

24.40 General. The examinations and tests prescribed in this Part will be conducted by an authorized representative of the Administrator.

24.41 Time and place. All examinations and tests will be held at such times and places as the Administrator or his representative may prescribe.

24.42 Inspection. The applicant for a mechanic certificate or rating shall offer full cooperation with respect to any inspection and examination which may be made of such applicant upon proper request by any authorized representative of the Administrator prior or subsequent to the issuance of a mechanic certificate or rating.

24.43 Standard of performance. All practical or theoretical examinations and tests shall be accomplished to the satisfaction of the Administrator, and the passing grade in each subject of examination or test shall be at least 70 percent.

24.5 Mechanic regulations.

24.50 Airman Rating Record requirement. A certificated mechanic who is directly in charge of packing parachutes or of the inspection, maintenance, or repair of certificated aircraft, aircraft engines, or their appliances, shall not engage in such service unless there is attached to his certificate the appropriate Airman Rating Record, prescribed and issued by the Administrator. Every holder of a valid mechanic certificate, or parachute rigger certificate, in effect on May 1, 1940, may perform service pursuant to such authority without an Airman Rating Record until the expiration, suspension, or revocation of such license or certificate.

24.51 Parachute packing. A certificated mechanic holding a currently effective parachute rigger rating shall not repack any parachute which is not in condition for safe use.

24.52 Major and minor parachute repairs. A certificated mechanic shall not make any major parachute repairs unless, at the time of making such repairs, he is in the employ of the manufacturer of the parachute or another parachute manufacturer deemed competent for the purpose by the Administrator. Unless prior approval has been obtained from the Administrator, such mechanic shall not pack or repack any parachute, or make any minor parachute repairs, such as the replacement of pack-opening rubbers, packs and pilot chutes, and the patching of holes and tears in silk, in a place other than where the following facilities for such operations are available:

(a) A suitable table, at least 3 feet by 40 feet, with smooth surface;
(b) A rack where parachutes can be suspended for drying and airing;
(c) Packing tools and repair equipment suitable for the repacking and repair of the type of parachute involved;
(d) Adequate housing facilities for the above equipment.

24.53 Factory mechanic rating limitations. The holder of a factory mechanic rating shall be limited to the inspection, maintenance, overhaul, or repair of aircraft, aircraft engines, propellers, or instruments constructed by the manufacturer employing the holder. Such work shall be performed only for such manufacturer and through the use of facilities provided by him.

24.54 Mechanic identification card. No person shall serve as a mechanic in connection with the inspection, maintenance, overhaul, or repair of aircraft, aircraft engines, propellers, or appliances thereof, or as a parachute rigger, after June 15, 1942, unless he has in his possession, in addition to a currently effective mechanic certificate, an identification card, satisfactory to the Administrator, containing his fingerprints, his picture, and his signature.

24.55 Recent experience requirements. The holder of a mechanic's certificate shall not exercise the privileges thereunder, unless within the preceding twenty-four calendar months he has:

(1) Served as a mechanic under the terms of his certificate and rating for at least six months of such twenty-four month period, or

(2) Demonstrated to the satisfaction of the Administrator that he is able to meet the standards currently prescribed by the Civil Air Regulations for the issuance of the certificate and rating.

24.56 Reports. The holder of a mechanic's certificate shall transmit to the Administrator, annually, during the month of January, a report for the preceding twelve-month period, setting forth the amount and type of his aeronautical experience and such other pertinent data as the Administrator may require.

24.57 Expired certificates: special issuance. The holder of a mechanic's certificate which has expired during the preceding twelve months may obtain a new certificate and the same rating theretofore held immediately prior to its expiration, upon application, by demonstrating to the satisfaction of the Administrator that he is able to meet the standards currently prescribed by the Civil Air Regulations for the issuance of the certificate and rating.

CIVIL AIR REGULATIONS

PART 43
GENERAL OPERATION RULES

Effective July 1, 1945

CIVIL
AERONAUTICS BOARD

WASHINGTON, D. C.

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43.10 Certificates and identification marks.

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43.9 Definitions.

43.0 GENERAL

43.00 Scope. The following rules govern the operation of civil aircraft in the United States.

43.1 AIRCRAFT CERTIFICATION AND IDENTIFICATION

43.10 Certificates and identification marks. Aircraft, except foreign aircraft authorized by the Administrator to be flown in the United States, shall not be operated unless the following requirements are met.

43.100 Registration certificate. A registration certificate issued to the owner of the aircraft shall be carried in the aircraft at all times.

NOTE: The owner of an aircraft is required to give immediate notice to the Administrator of any change of address. For other rules governing the registration and recordation of aircraft ownership see Administrator's Regulations 501 and 503.

43.101 Airworthiness certificate. An airworthiness certificate or special authorization issued by the Administrator approving its operation shall be carried in the aircraft at all times during flight.

NOTE: Usually the manufacturer obtains the airworthiness certificate which thereafter remains with the aircraft. If no airworthiness certificate has been issued for the aircraft, or if it has expired, the owner shall obtain this certificate.

43.1010 Aircraft operation record. An aircraft for which an airworthiness certificate is currently in effect shall not be operated unless there is atttached to such airworthiness certificate an appropriate aircraft operation record prescribed and issued by the Administrator, nor shall such aircraft be operated other than in accordance with the limitations prescribed and set forth by the Administrator in such record. Any change made to the aircraft which affects these limitations shall be made under the supervision of an appropriately rated mechanic or other person authorized by the Administrator and such change shall be noted in the aircraft operation record.

43.1011 Duration. An airworthiness certificate shall remain in effect until a termination date is fixed by the Board, unless it is suspended or revoked.

43.1012 Transferability. The airworthiness certificate and the attached currently effective aircraft operation record, upon transfer of ownership, shall remain with the aircraft for which they were issued.

43.1013 Surrender. Upon the cancellation, suspension, or revocation of an airworthiness certificate the owner of the aircraft must, upon request, surrender such certificate to an authorized representative of the Administrator.

43.102 Identification marks. Aircraft identification marks shall be displayed on aircraft in the manner prescribed by the Administrator. Aircraft identification marks are as follows:

(a) **NC.** Roman capital letters NC followed by the registration symbols shall be displayed on aircraft which fully comply with the minimum airworthiness requirements specified in the Civil Air Regulations.

(b) **NR.** Roman capital letters NR followed by the registration symbols shall be displayed on aircraft which fully comply with airworthiness requirements of the Civil Air Regulations, except those rendered inapplicable by the nature of a special purpose for which the aircraft is to be used, and the airworthiness requirements not met are compensated by suitable operating restrictions imposed by the Administrator after making a finding that the aircraft, when operated for the special purpose in accordance with the restrictions placed thereon and carrying only the crew necessary for this special operation, provides a level of safety equivalent to that of an aircraft which fully meets the provisions of the airworthiness requirements of the Civil Air Regulations.

(c) **NX.** Roman capital letters NX followed by the registration symbols shall be displayed on aircraft which have not fully complied with the airworthiness requirements specified in the Civil Air Regulations and are to be operated only for experimental purposes when, in the opinion of the Administrator, such aircraft can be operated with appropriate restrictions without endangering public safety. In addition, the word "experimental" shall be prominently displayed near the entrance to the cabin or cockpit of any aircraft holding an experimental certificate.

(d) **Other marks or symbols.**

(*1*) No design, mark, or symbol which modifies the identification mark shall be placed on aircraft, except with the approval of the Administrator.

(*2*) No design, mark, or symbol which confuses the identification mark shall be placed on the aircraft.

43.1020 Export aircraft. An aircraft manufactured in the United States for delivery outside the United States or its possessions shall display such identification marks or insignia as are approved by the Administrator. Such aircraft shall be operated only for the purpose of test and demonstration flights for a limited period of time or while in necessary transit to the purchaser.

43.2 MAINTENANCE

43.20 General. An aircraft shall not be flown unless it is in airworthy condition. Mechanical work other than routine maintenance must be performed in accordance with § 18.50.

43.21 Flight tests. When an aircraft has undergone any repair or alteration which may have appreciably changed its flight characteristics or substantially affected its operation in flight, such aircraft, prior to carrying passengers, shall be test flown by at least a private pilot appropriately rated for the aircraft, and a notation to that effect shall be entered by such pilot in the aircraft log.

43.22 Annual inspection. An aircraft shall not be flown, except for airworthiness flight tests, unless within the preceding 12 calendar months it has been given an annual inspection as prescribed by the Administrator and has been found to be airworthy by a person designated by the Administrator. A copy of the last inspection report shall be attached to the aircraft operation record and a copy filed with the Administrator.

43.23 Periodic inspection. An aircraft shall not be flown for hire unless within the preceding 100 hours of flight time it has been given a periodic inspection by an appropriately rated mechanic and has been found to be airworthy and a notation to that effect has been entered by such mechanic in the aircraft log. The annual inspection required by § 43.22 will be accepted as one such periodic inspection.

43.24 Aircraft and engine logs. The registered owner shall keep accurate, current, permanent records of the total flight time of the aircraft and the running time of each engine. Such records shall be kept in logbooks or other suitable systems readily available for transfer with the aircraft or individual engine and, upon request, must be presented to an authorized representative of the Administrator or Board. A mechanical device which records the total amount of operation or the total number of engine revolutions may be used in lieu of such aircraft and engine records.

43.25 Rebuilt engine logs. A new record without previous operating history may be used for an aircraft engine rebuilt by the manufacturer or any agency approved by the manufacturer for such work, provided such new record contains a signed statement by such manufacturer or agency giving the date the engine was rebuilt and such other information as the Administrator may require.

43.3 AIRCRAFT INSTRUMENTS AND EQUIPMENT

43.30 NC powered aircraft instruments and equipment. The following instruments and equipment, or instruments and equipment which the Administrator has found to be the equivalent, are required for the particular type of operation specified:

(a) **Contact flight rules (day).**

(*1*) air-speed indicator,
(*2*) altimeter,
(*3*) magnetic direction indicator,
(*4*) tachometer for each engine,
(*5*) oil pressure gauge for each engine using pressure system,
(*6*) temperature gauge for each liquid-cooled engine,
(*7*) oil temperature gauge for each air-cooled engine,
(*8*) manifold pressure gauge, or equivalent, for each altitude engine,
(*9*) fuel gauge indicating the quantity of fuel in each tank,
(*10*) position indicator, if aircraft has retractable landing gear,
(*11*) approved flotation gear readily available for each occupant and a Very pistol or equivalent signal device, if the aircraft is operated for hire over water beyond gliding distance from shore without the aid of power,
(*12*) certificated safety belts for all passengers and members of the crew.

(b) **Contact flight rules (night).**

(*1*) equipment specified in § 43.30 (a),
(*2*) set of certificated forward and rear position lights,
(*3*) one electric landing light, if the aircraft is operated for hire,
(*4*) certificated landing flares as follows, if the aircraft is operated for hire beyond a 3-mile radius from the center of the airport of take-off:

Maximum authorized weight of aircraft	**Flares**
3,500 pounds or less	5 class-three or 3 class-two
3,500 pounds to 5,000 pounds	4 class-two
above 5,000 pounds	2 class-one or 3 class-two and 1 class-one

If desired, flare equipment specified for heavier aircraft may be used.

(*5*) an adequate source of electrical energy for such electrical and radio equipment as is installed,
(*6*) one spare set of fuses or 3 spare fuses of each magnitude.

(c) **Instrument flight rules.**

(*1*) equipment specified for contact flight rules in §43.30 (a) and, for night flight, equipment specified in §43.30 (b),
(*2*) two-way radio communications system and navigational equipment appropriate to the ground facilities to be used,
(*3*) gyroscopic rate-of-turn indicator,
(*4*) bank indicator,
(*5*) sensitive altimeter adjustable for change in barometric pressure,
(*6*) clock with a sweep-second hand,
(*7*) generator of adequate capacity.

43.68 Recent flight experience. The following rules govern recent flight experience:

43.680 General. No person shall pilot an aircraft carrying passengers unless within the preceding 90 days he has made at least 5 take-offs and landings to a full stop in aircraft of the same type and class, and of a rated horsepower within 50 per cent of the horsepower of the aircraft to be flown.

43.681 Night flight. No person shall pilot an aircraft carrying passengers during the period from one hour after sunset to one hour before sunrise, unless he has made at least 5 take-offs and landings to a full stop during such period within the preceding 90 days.

43.682 Instruction flight. A flight instructor shall not exercise the privileges of the instructor rating unless within the preceding 12 calendar months he has either:

(a) given at least 10 hours of flight instruction while appropriately rated, or
(b) demonstrated his continued proficiency to the Administrator.

43.683 Instrument flight. A pilot shall not pilot an aircraft under instrument flight rules unless he has had at least 6 hours of instrument flight under actual or simulated flight conditions during the preceding 6 calendar months or until he has had 6 hours of such flight time under:

(a) actual instrument conditions, accompanied by a pilot of at least private rating holding an appropriate aircraft and instrument rating, or

(b) simulated instrument conditions in an aircraft, accompanied by a pilot of at least private rating holding an appropriate aircraft rating, or

(c) simulated instrument conditions in equipment approved by the Administrator, except that at least 3 hours must have been had in accordance with paragraph (a) or (b).

43.9 DEFINITIONS

(a) **Pilot** is a person holding a valid pilot certificate issued by the Administrator.

(b) **To pilot** means to be in command of the aircraft during take-off, in flight, or landing.

(c) **Passenger** is an occupant of the aircraft in flight other than a crew member.

(d) **Flight instructor** means a private or commercial pilot who possesses a valid flight instructor rating.

(e) **Routine maintenance** is defined as simple or minor preservation operations, including but not limited to the adjustment of rigging and clearances, and the replacement of small standard parts not involving complex assembly operations.

CIVIL AIR REGULATIONS

PART 98—DEFINITIONS

Sec.
98.0 (Unassigned).
98.1 Definitions.
98.100 Administrator.
98.101 Board.
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98.104 Acrobatics.
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98.110 Ceiling.
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98.0 (Unassigned).

98.1 Definitions. The following definitions, in addition to those in the Civil Aeronautics Act of 1938, as amended, (See Section 1) and those appearing elsewhere in Civil Air Regulations, shall be applicable to the terms so defined.

98.100 Administrator. Administrator, as used, except as otherwise specifically provided in the Civil Air Regulations, shall mean the Administrator of Civil Aeronautics, or an officer or employee of the Administrator of Civil Aeronautics designated by him in writing for the purpose specified in such designation.

98.101 Board. Board, except as otherwise specifically provided in the Civil Air Regulations, shall mean the Civil Aeronautics Board, or an officer or employee of the Civil Aeronautics Board, designated by it in writing.

98.102 Authority. Authority, except as otherwise specifically provided in the Civil Air Regulations, shall mean the Civil Aeronautics Authority, including the Civil Aeronautics Board and the Administrator of Civil Aeronautics, or an officer or employee of either the Board or Administrator. designated in writing.

98.103 (Unassigned).

98.104 Acrobatics (Acrobatic Flight). Acrobatics are unnecessary flight evolutions voluntarily performed with an aircraft requiring or resulting in an abrupt change in its attitude, an abnormal attitude, or operations in excess of the aircraft's design level flight speed (placard value). A normal bank not in excess of 70 degrees will not be considered as an abrupt change in the aircraft's attitude or as an abnormal attitude.

98.105 Airline. An established system of aerial transportation, its equipment, or the company owning or operating it.

98.106 Airship. An aerostat provided with a propelling system and with means of controlling the direction of motion.

98.107 Amphibian. An airplane designed to rise from and alight on either land or water.

98.108 Balloon. An aerostat without a propelling system.

98.109 Beacon. A light, group of lights, or other signaling device, indicating a location or direction.

98.1090 Airport beacon. A beacon light of high candlepower located at or near an airport for the purpose of indicating the general or specific location of the airport.

98.1091 Airway beacon. A beacon light of high candlepower, other than an airport or landmark beacon, located on or near an airway for the purpose of indicating the location of an airway.

98.1092 **Auxiliary airport beacon.** A beacon light, usually of lower candlepower than the main airport beacon light, located on the airport site to indicate the specific location of an airport that has a separate airport beacon visible at a greater distance to indicate the general location of the airport.

98.1093 **Auxiliary airway beacon.** A beacon light, usually of lower candlepower than the principal airway beacon lights, used to mark special features of the terrain along an airway or otherwise to supplement the principal airway beacons.

98.1094 **Code beacon.** A flashing beacon light having a recognizable characteristic of dots and dashes by which its individual identity can be established.

98.1095 **Landmark beacon.** A beacon light, other than an airport beacon or an airway beacon, that serves to indicate a definite geographical location.

98.110 **Ceiling.** Ceiling is the distance from the cloud base to the ground.

98.1100 **Absolute ceiling.** The maximum height above sea level at which a given airplane would be able to maintain horizontal flights under standard air conditions.

98.1101 **Service ceiling.** The height above sea level under standard air conditions, at which a given airplane is unable to climb faster than a small specified rate (100 feet per minute in the United States and England). This specified rate may differ in different countries.

98.111 **Controls.** A general term applied to the means provided to enable the pilot to control the speed, direction of flight, altitude, power, etc., of an aircraft.

98.112 **Landplane.** An airplane designed to rise from and alight on the land.

98.113 **Parachute.** An umbrella-like device used to retard the descent of a falling body by offering resistance to its motion through the air.

98.114 **Property.** Property, as used, shall not include any personal belongings.

98.115 **Radio range station.** A radio transmitter supplying directive radio waves that provide a means of keeping an aircraft on its proper course.

98.116 **Seaplane.** An airplane designed to rise from and alight on the water. This includes both the boat and float types.

98.117 (Unassigned).

98.118 **Speed.**

98.1180 **Airspeed.** The speed of an aircraft relative to the air.

98.1181 **Ground speed.** The horizontal component of the velocity of an aircraft relative to the ground.

98.1182 **Landing speed.** The minimum speed of an airplane at the instant of contacts with the landing area in a normal landing.

98.1183 **Minimum flying speed.** The lowest steady speed that can be maintained, with any throttle setting whatsoever, by an airplane in level flight at an altitude above the ground greater than the span of the wings.

98.1184 **Stalling speed.** The speed of an airplane in steady flight at its maximum coefficient of lift.

98.119 **Spin.** A maneuver in which an airplane descends along a helical path of large pitch and small radius while flying at a mean angle of attack greater than the angle of attack at maximum lift.

98.120 **Stall.** The condition of an airfoil or airplane in which it is operating at an angle of attack greater than the angle of attack of maximum lift.

98.121 **Visibility.** The greatest distance toward the horizon at which conspicuous objects can be seen and identified.

REGULATIONS OF THE ADMINISTRATOR OF CIVIL AERONAUTICS
PART 501 — AIRCRAFT REGISTRATION CERTIFICATES

Sec.

501.1 Application
501.2 Issuance of Registration Certificate
501.20 Previously registered aircraft
501.21 New or previously unregistered aircraft
501.22 Effective date
501.3 Transferability
501.4 Duration
501.5 Display
501.6 Invalidation
501.7 Surrender

501.1 — **Application.** Application for the registration of an aircraft shall be made upon the applicable form prescribed and furnished by the Administrator.

501.2—**Issuance of Registration Certificate.**

501.20—**Previously registered aircraft.** A registration certificate will be issued by the Administrator for aircraft previously registered under the provisions of the Civil Aeronautics Act of 1938, as amended, only if:

(a) The applicant mails or delivers a duly executed application for registration to the Administrator; and

(b) The applicant submits with such application proof satisfactory to the Administrator that the applicant is a citizen of the United States*; and

(c) The applicant submits with the application for registration a conveyance which meets the requirements prescribed in Part 503 of the Regulations of the Administrator of Civil Aeronautics, evidencing his ownership of the aircraft; and

(d) The conveyance submitted with the above application establishes in the recordation system of the Administrator, title to the aircraft in the applicant: *Provided,* that this requirement shall not be applicable to contracts of conditional sale in which the seller is the recorded owner of the aircraft.

501.21—**New or previously unregistered aircraft.** A registration certificate will be issued by the Administrator or his authorized inspector for aircraft not previously registered under the provisions of the Civil Aeronautics Act of 1938, as amended, only if:

(a) The applicant mails or delivers a duly executed application for registration to the Administrator or his authorized inspector; and

(b) The applicant submits with such application proof satisfactory to the Administrator that the applicant is a citizen of the United States; and

(c) The applicant submits satisfactory proof of ownership of such aircraft.

501.22—**Effective Date.** Aircraft will be deemed to be registered upon the date that the documents required by sections 501.20 and 501.21, whichever is applicable, are received by the Administrator or his authorized inspector.

501.3—**Transferability.** A registration certificate is not transferable except that upon the transfer of ownership of an aircraft registered as civil aircraft of the United States, the registration and certificate issued pursuant thereto may be transferred to the purchaser upon the following conditions.

(a) The purchaser is a citizen of the United States; and

(b) On the date the registered owner transfers ownership of such aircraft, he shall endorse the registration certificate in the manner provided thereon and deliver such certificate to the purchaser; and

(c) On the date of transfer, an application for registration of the aircraft in the name of the purchaser, together with all documents required by section 501.20, are mailed to the Administrator.

*"Citizen of the United States" means (a) an individual who is a citizen of the United States or of one of its possessions, or (b) a partnership of which each member is such an individual, or (c) a corporation or association created or organized under the laws of the United States or of any State, Territory or Possession of the United States, of which the president and two-thirds or more of the board of directors and other managing officers thereof are such individuals and in which at least 75 per centum of the voting interest is owned or controlled by persons who are citizens of the United States or of one of its possessions. (Section 1 (13), Civil Aeronautics Act of 1938.)

* 501.4—**Duration.** The registration and certificate issued pursuant thereto shall remain in effect indefinitely unless suspended or revoked; *Provided,* that such registration and certificate may be cancelled by the Administrator at any time within 90 days after issuance and thereafter they shall immedidately expire upon the date:

(a) The aircraft is registered under the laws of any foreign country; or

(b) The registration of the aircraft is cancelled at the written request of the owner; or

(c) The aircraft is totally destroyed or scrapped; or

(d) The ownership of the aircraft is transferred, unless the certificate is transferred in accordance with section 501.3.

501.5—**Display.** A registration certificate shall be carried at all times in the aircraft and shall be presented upon the request of any duly authorized representative for the Administrator, or any state or municipal official charged with enforcing local laws or regulations involving Federal compliance.

501.6—**Invalidation.** Any registration of an aircraft by the Administrator shall be null and void if at the time of registration:

(a) The aircraft was registered under the laws of any foreign country; or

(b) The person registered as owner was not the true and lawful owner of the aircraft; or

(c) The person registered as owner was not a citizen of the United States; or the interest of such person in the aircraft was created by any transaction not entered into in good faith, but for the purpose of avoiding, with or without the knowledge of the registered owner, the provision of the Civil Aeronautics Act of 1938, as amended, prohibiting the registration of an aircraft in the name of a person not a citizen of the United States.

501.7—**Surrender.** Upon the suspension, revocation, expiration or invalidation of a registration certificate, the owner of the aircraft shall, upon request, surrender such certificate to any authorized representative of the Administrator.

501.8—**Notice of Change of Address.** The registered owner of any aircraft shall notify the Administrator immediately of any change of address.

REGULATIONS OF THE ADMINISTRATOR OF CIVIL AERONAUTICS
PART 503 — RECORDATION OF AIRCRAFT OWNERSHIP

Sec.
503.1 Recordation Required.
503.2 Eligibility.
503.3 Notice of Transfer.

503.1— Recordation Required. All conveyances affecting the title to, or interest in, any aircraft registered under the provisions of the Civil Aeronautics Act of 1938, as amended, shall be executed upon the applicable form prescribed by the Administrator, or a form deemed by the Administrator to be its equivalent, and shall be recorded with the Administrator.

503.2—Eligibility. A conveyance shall be eligible for recordation only if:

(a) It is accompanied by a duly executed application for registration, together with all the documents required by section 501.2 of the Regulations of the Administrator of Civil Aeronautics: *Provided,* that this paragraph shall not apply to conveyances affecting an interest in, but not title to the aircraft, or conveyances transferring ownership to a person not eligible to obtain registration; and

(b) It is accompanied by a Certificate of Ownership for the aircraft which is the subject of the conveyance, if such certificate has been issued by the Administrator,* *Provided,* that, in the event of the loss or destruction of such Certificate of Ownership, the owner shall submit in lieu thereof proof satisfactory to the Administrator that such certificate has been destroyed or lost; and

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*On or after the effective date of these regulations the Administrator will issue a Certificate of Ownership which lists ownership and liens as of that date. These certificates of ownership will be issued for each aircraft as to which a conveyance is received for recordation. Thereafter no conveyance will be eligible for recordation unless accompanied by a Certificate of Ownership.

(c) It affects an aircraft currently registered under the terms of the Civil Aeronautics Act of 1938, as amended; and

(d) It states the interest in the aircraft of the person by whom such conveyance is made or given, or in the case of a contract of conditional sale, the interest of the seller; and

(e) It states the interest transferred by the conveyance; and

(f) It is acknowledged before a Notary Public or other officer authorized by law of the United States, or of a State, Territory or possession thereof, or the District of Columbia, to take acknowledgment of deeds.

503.3—Notice of Transfer. The registered owner of any aircraft, within five days after the conveyance of such aircraft, or other disposition thereof, shall furnish the Administrator, upon the prescribed form, notice of sale or other disposition of the aircraft.

Late Amendments

Civil Air Regulations Amendment 14-1
Effective: October 19, 1945

PROPELLER IDENTIFICATION DATA

Effective October 19, 1945, § 14.06 of the Civil Air Regulations is amended by striking the following:

"; and maximum power and maximum speed for which certification has been granted."

Civil Air Regulations Amendment 01-1
Effective: October 31, 1945

DURATION OF AIRWORTHINESS CERTIFICATE

Effective October 31, 1945, § 01.13 of the Civil Air Regulations is repealed.

By the Civil Aeronautics Board:

/s/ Fred A. Toombs

Fred A. Toombs
Secretary

Notes

Notes

Notes

SECTION THIRTEEN

CHECK QUESTIONS FOR MECHANICS

1. What is a major alteration? See C.A.R. Part 18, Section 41.

2. Must each engine have an independent oil supply? See C.A.R. Part 03, Section 43.

3. What is a minor change in regard to aircraft engines? See Part 13, Section 11.

4. What are the installation requirements of the anchor (riding lights) on a seaplane? See Part 03, Sections 539 and 5390.

5. The airworthiness certificate of an aircraft denotes that the aircraft is in the "acrobatic" category. Is the aircraft restricted to flight maneuvers? See Part 03, Section 01.

6. What is a minor alteration? See Part 18, Section 401.

7. Are emergency exits required on aircraft carrying more than 5 persons? See Part 03, Section 3812.

8. The powerplant installation is composed of what component parts or units? See Part 03, Section 40.

9. How much propeller end tip clearance (longitudinal clearance) is required between propeller blades or cuffs and stationary portions of the airplane? See Part 03, Section 4112.

10. May an aircraft or part which has failed in flight and caused serious injury to a person be repaired or salvaged or be disposed of in any manner before permission has been obtained from the Civil Aeronautics Board or by an authorized representative (C.A.A.)? See Part 01, Sections 310 and 311.

11. What is the passing grade for all practical and theoretical examinations and tests for mechanic certificate ratings? See Part 24, Section 43.

12. Are independent throttle controls required for each engine? See Part 03, Section 4800.

13. Is a registration certificate transferable, and if so, under what conditions See Part 501, Section 3.

14. What is meant by an "Operation Test on a new type of aircraft engine? A "Cal bration Test" - "Tear-down Test" and an "Endurance Test"? See Part 13, Sections 213 to 216.

15. Must the owner of a registered aircraft surrender the registration certificate upon the request of any authorized representative of the Administrator? See Part 501, Section 7.

16. Must separate controls be provided to regulate the temperature of the carburetor air for each engine? See Part 03, Section 4805.

17. What letter suffix on the airworthiness certificate of an aircraft denotes that the aircraft is in the "utility" category? See Part 03, Section 01.

18. When may a C.A.A. Inspector make inspections and tests which are necessary to determine compliance with the Civil Ai Regulations? See Part 13, Section 13.

19. What is the status of a certificate aircraft displaying the Roman capital letters "NX" before its registration number? Is it airworthy? See Part 03, Section 02

20. Must the registered owner of any aircraft notify the Administrator (C.A.A. immediately of any change of address? Se Part 501, Section 8.

21. If a C.A.A. certificated mechanic h had his mechanic certificate revoked, may again at a later date make application fo new certificate? If so, how much time mu elapse before he can again make applicati for a new certificate? See Part 24, Sect 38.

22. Are pulley guards required on all control cables? See Part 03, Section 3571.

23. Must a registration certificate be carried in the aircraft at all times? See Part 501, Section 5.

24. Must a certificated mechanic always have in his possession an identification card approved by the Administrator (C.A.A.) containing his fingerprints, his picture and his signature? See Part 24, Section 54.

25. What minimum angle is permissible for change of direction by means of Fairleads? See Part 03, Section 3571.

26. How much water clearance (radial clearance) is required of any seaplane and propeller combination? See Part 03, Section 4112.

27. Must fuel systems be so arranged as to permit any one fuel pump to draw fuel from only one tank at a time? See Part 03, Section 421.

28. What instruments have special markings for operation limitations marked on their cover glasses? See Part 03, Section 610.

29. Is load distribution information stated on the airplane placard? See Part 03, Section 620.

30. Who may revoke a C.A.A. mechanic certificate? See Part 24, Section 38.

31. How can a mechanic determine the fuel capacity of a fuel tank? See Part 03, Section 6111.

32. Is a manufacturer's identification plate required to be attached to all engines? See Part 13, Section 22.

33. Who retains possession of an Airman's Rating Record and what relation does it bear to the Airman's mechanic certificate? See Part 24, Section 50.

34. When is a reverse current cut-out required in generator controls? See Part 03, Section 5311.

35. When an airman's certificate is revoked or suspended, must the holder surrender his certificate, upon request, to any officer or employee of the Civil Aeronautics Administration? See Part 24, Section 35.

36. Must all closed cabin airplanes designed for carrying passengers have at least one adequate and easily accessible external door? See Part 03, Section 3821.

37. How long does a registration certificate remain in effect unless suspended or revoked? See Part 501, Section 4.

38. When is a propeller said to have failed as interpreted from the Civil Air Regulations? See Part 14, Section 230.

39. Are all examinations for mechanic certificates conducted by an authorized representative of the Administrator (C.A.A.)? See Part 24, Section 41.

40. Where can standard C.A.A. inspection report forms be obtained? See Part 01, Section 25.

41. May a mechanic reduce the diameter of a propeller by cutting off the tips? See Part 14, Section 54.

42. What constitutes a major change on an aircraft engine? See Part 13, Section 310.

43. Will lack of continuous aeronautical experience be apt to cause a mechanic's certificate to expire? See Part 24, Section 55.

44. What quality and strength characteristics must new materials have before they can be used in engine overhaul and repair operations? See Part 13, Section 200.

45. How many days duration is a mechanic's certificate in effect unless notified otherwise? See Part 24, Section 32.

46. What letter suffix denotes that an aircraft is in the "Normal" category? See Part 03, Section 01.

47. For what reason may the registration of an aircraft become null and void? See Part 501, Section 6.

48. Does a holder of a factory mechanic rating automatically cancel his airman's rating if he terminates his employment with the factory and specific product referred to in his factory mechanic's rating? See Part 24, Section 32.

49. What is a "Forced Stop" when the reference is to a new type engine being block-tested? See Part 13, Section 2151.

50. What is an alteration? See Part 18, Section 4.

51. When skiis without special stabilizing devices are installed, must front and rear check cables be used? See Part 03, Section 3660.

52. If a mechanic's certificate has expired during the last preceding twelve months, may the holder secure a new certificate and the same rating as formerly held if he demonstrates to the Administrator that he is able to meet the standards currently prescribed by the C.A.R.? See Part 24, Sections 55 and 57.

53. Pushing the right rudder pedal forward causes the nose of the airplane to move in what direction? See Figure 03-14.

54. What aeronautical knowledge does C.A.R. Part 24 state is required of airplane engine mechanics? See Part 24, Section 210.

55. What basic equipment is required for type and airworthiness certification of an airplane? See Part 03, Section 51.

56. What are the essential requirements of mechanic identification cards? See Part 24, Section 54.

57. When does a registration certificate automatically expire? Name four (4) conditions. See Part 501, Section 4.

58. Instrument lines carrying inflammable fluids or gases under pressure are required to be provided with what safety devices? See Part 03, Section 5221.

59. What recent experience must a certificated mechanic have had if he has not actively and continuously worked as a mechanic for the entire last preceding year? See Part 24, Section 55.

60. What are the installational and marking requirements for powerplant controls?? See Part 03, Section 480.

61. As used in the C.A.R., who is a citizen of the United States? See Part 501, Section 20.

62. What minimum degree of error in heading is permissible after a magnetic direction indicator has been installed and compensated? See Part 03, Section 5213.

63. What source of energy is used to operate air-driven gyroscopic instruments? See Part 03, Section 5215.

64. Must hydraulic oil lines carrying inflammable fluids into a fire zone be provided with shut-off valves? See Part 03, Section 5612.

65. Must an aircraft owner make application for the registration of the aircraft on a form furnished by the Administrator (C.A.A.)? See Part 501, Section 1.

66. Can hydraulic accumulators or pressurized reservoirs be installed on the engine side of the firewall? See Part 03, Section 5613.

67. Are authorized center of gravity (c.g.) limits stated on the airplane placard? See Part 03, Section 620.

68. Must an aircraft owner who is making application for the registration of an aircraft supply ample documentary evidence of ownership before the registration certificate will be issued by the Administrator (C.A.A.)? See Part 501, Section 21.

69. May a certificated mechanic holding an appropriate parachute rigger's rating perform any parachute repairs in any convenient location and does he need any specified equipment to do so? See Part 24, Section 52.

70. What is the color of emergency exit placards and the operating controls? See Part 03, Section 6122.

71. What must the registered owner do with the registration certificate when he transfers ownership of the aircraft to the purchaser of the aircraft? See Part 501, Section 3.

72. What weight information is included in the weight portion of the airplane placard? See Part 03, Section 620.

73. What minimum flight crew is required by the Civil Air Regulations for an airplane during any contact flight? See Part 03, Section 603.

74. Must an applicant for C.A.A. mechanic certificate be able to read, write and speak the English language? See Part 24, Section 13.

75. Are operating limitations and information relative to the airplane type design required to be readily available to the crew or pilot? See Part 03, Section 6.

76. Does the Administrator or his representative (C.A.A.) prescribe the time and places for conducting examinations? See Part 24, Section 41.

77. Must fuel tank vents for acrobatic type airplanes be of a nature so as to prevent excessive loss of fuel during acrobatic maneuvers especially during short periods of inverted flight? See Part 03, Section 42324.

78. Are undrainable points permitted in a fuel tank vent line? See Part 03, Section 42323.

79. At what time during the year does the holder of a mechanic's certificate transmit his yearly aeronautical experience report to the Administrator (C.A.A.)? See Part 24, Section 56.

80. Where are placards displayed? See Part 03, Section 61.

81. What letter suffix denotes that an aircraft is in the "Acrobatic" category? See Part 03, Section 01.

82. What is the status of a certificated aircraft displaying Roman capital letters "NR" before its registration number? Is it airworthy? See Part 03, Section 02 and Part 43, Section 102.

83. What is the status of a certificated aircraft displaying Roman capital letters "NC" in front of its registration numbers? See Part 03, Section 02.

84. Is a means provided in wing flap controls to indicate the flap position to the pilot? See Part 03, Section 353.

85. What data is required to be visibly and plainly displayed on the propeller? Where may such information be placed and how is such information attached? See Part 14, Section 06.

86. What must an applicant for a C.A.A. mechanic certificate who has failed on only the examination dealing with Civil Air Regulations do before he can again make application for a re-examination? See Part 24, Section 36.

87. Define "airplane configuration". See Part 03, Section 0703.

88. Is a C.A.A. certificated aircraft mechanic permitted, by the C.A.R., to work on engines or propellers? See Part 24, Section 50.

89. What conditions must be considered when installing movable tail surfaces? See Part 03, Section 342.

134. On variable pitch propellers with constant speed controls, must suitable means be provided to limit the speed of the propeller? See Part 03, Section 4112.

135. Is an authorized representative of the Administrator (C.A.A.) permitted at any time and place to make inspections and tests which are necessary to determine compliance with C.A.R. requirements? See Part 01, Section 23.

136. Are engine accessories block-tested along with an engine which is being block-tested? See Part 13, Section 21.

137. What test pressure must fuel tanks be capable of withstanding? See Part 03, Section 4230.

138. In what direction is the throttle moved to open? See Figure 03-14.

139. Are all spark ignition aircraft engines required to be equipped with a complete dual or twin ignition system? See Part 13, Section 2023.

140. Must all oil piping have an inside diameter equal to that of the engine oil pump inlet or outlet? See Part 03, Section 432.

141. What are the mechanical requirements of pressure cross feed fuel line arrangements which pass through portions of the airplane devoted to carrying personnel or cargo? See Part 04, Section 4211.

142. Is it compulsory to have a positive means of quickly cutting off all ignition systems on multi-engined aircraft? See Part 03, Section 4801.

143. What is the required method of supporting fuel tanks in the airplane structure? See Part 03, Section 4231.

144. Must the registration certificate be presented upon request of any authorized representative of the Administrator (C.A.A.) or Municipal Office charged with enforcing Federal laws or regulations? See Part 501, Section 5.

category? See Part 03, Section 01.

145. Must an applicant for a C.A.A. mechanic certificate rating cooperate with and oblige if an authorized representative of the Administrator (C.A. properly requests any inspection or examination? See Part 24, Section 42.

146. When is it permissible to have pressure cross feed fuel lines pass through portions of the airplane devote to carrying personnel or cargo? See Part 03, Section 4211.

147. Upon the transfer of ownership of an aircraft, must the registered owner deliver the registration certificate to the purchaser and at the same time make application to the Administra tor for registration of the aircraft ir the name of the purchaser? See Part 501, Section 22.

148. Are parts subject to angular motion and connected to turnbuckles allowed any degree of binding throughout the range of travel of the part? See Part 03, Section 3571.

149. What is the minimum age requirement for aircraft mechanic certificate applicants? See Part 24, Section 10.

150. Must all control systems be provided with stops which limit the range of motion of the control surfaces? See Part 03, Section 354.

151. When an applicant has once failed to pass his C.A.A. examination, how many hours of study is he required to do before taking a reexamination of the C.A.R? See Part 24, Section 36.

152. Must certificated propellers be installed in certificated airplanes? See Part 03, Section 411.

153. When does a C.A.A. certificated mechanic's rating become void? See Part 24, Section 32.

154. What precautions must be observed when control surface locks are provided in a control system? See Part 03, Section 355.

ber? See Part 18, Section 531.

155. What engine speed limitations are placed on fixed pitch propellers and ground adjustable propellers during take-off and initial climb periods? See Part 03, Section 41110.

156. When a registered aircraft owner sells his airplane to another person, does the new owner or the former owner take possession of the airworthiness certificate and aircraft operations record? See Part 01, Section 14.

157. Are stops required in the propeller mechanism to restrict the pitch range and speed of controllable pitch propellers not having constant speed controls? See Part 03, Section 41111.

158. Can logbook entries be made without much regard for neatness? See Part 02, Section 27.

159. What is the time limit required to extend fully or to retract wing flaps as required by the C.A.R? See Part 03, Section 353.

160. When is an airplane eligible for an airworthiness certificate? See Part 01, Section 11.

161. What recordings are required in the Aircraft logbooks or Aircraft engine logbooks belonging to a certificated aircraft? See Part 01, Section 27.

162. Is the aircraft logbook supposed to contain an operational history of the aircraft and if so, what type of recordings are entered therein? See Part 01, Section 27.

163. Are excessive or hazardous changes in cable tension throughout the range of travel permissible? See Part 03, Section 3571.

164. Where can standard forms for aircraft registration be obtained? See Part 501, Section 1.

165. Is it permissible to allow a cable to rub the pulley flange? See Part 03, Section 3571.

166. Is an airworthiness certificate ordinarily endorsed each year? See Part 01, Section 13.

167. Is it permissible to allow carburetor air intake drains to discharge fuel in the path of exhaust flames? See Part 03, Section 452.

168. What is the minimum clearance permitted between propeller tips and any part of the airplane structure? See Part 03, Section 4112.

169. What is meant by the use of the term "United States" in the Civil Air Regulations? See Part 01, Section 30.

170. What is an aircraft of the United States? See Part 01, Section 10.

171. Under what conditions can an aircraft or part of it be removed after it has met with an accident and a person is seriously or fatally injured? Name four conditions under which wreckage can be moved or disturbed and what precautions should be taken if it is deemed necessary to move or disturb the wreckage? See Part 01, Section 310.

172. Name several conditions which must not prevail in control systems. See Part 03, Section 3570.

173. After a certificated aircraft has been repaired or received alterations made by a mechanic appropriately certificated by C.A.A., is it necessary that the aircraft be presented for inspection by a duly authorized C.A.A. inspector before flight operations are resumed? See Part 01, Section 26.

174. May clevis pins retained in position by means of cotter pins be used in a control system if the clevis pins are subject to load or motion? See Part 03, Section 3571.

175. What is an Aircraft Operation Record? See Part 01, Section 12.

176. Can a pilot having only a pilot's certificate make a periodic inspection of a certificated aircraft and make authoratative recordings of his findings on the Periodic Aircraft Inspection Report form and aircraft logbook? See Part 01, Section 25.

177. What is meant by the term "Board" as used by the C.A.R? See Part 98, Section 101

178. Is the fit between pulley guards and pulleys as used in a control system an important safety factor? See Part 03, Section 3571.

179. Who may make application for an airworthiness certificate? See Part 01, Section 10 and Part 03, Section 02.

180. When does an airworthiness certificate expire? Name three conditions which may cancel an airworthiness certificate. See Part 01, Sections 13 and 21.

181. What special precautions should be taken in cockpit design and construction to prevent foreign objects from getting into places where they might jam the controls? See Part 03, Section 3570.

182. Where can standard C.A.A. report forms be obtained? See Part 01, Section 25.

183. Must pulleys and the cables used with them lie in the same plane? See Part 03, Section 3571.

184. Must the registered owner of a certificated aircraft present or cause to be presented the airworthiness certificate upon demand by an authorized representative of the Administrator or any officer of the law charged with enforcing Federal laws or regulations? See Part 01, Section 20.

185. What is the smallest cable allowed for use in primary control systems? See Part 03, Section 3571.

186. Is a statement of duration a part of all airworthiness certificates? See Part 01, Section 13.

187. Who is responsible for making sure that periodic inspections are made at the correct time and by properly certificated persons? See Part 01, Section 26.

188. Must pulley types and sizes correspond to the cablesswith which they are used, as specified in the pulley specification? See Part 03, Section 3571.

189. What entries should an aircraft engine manufacturer who has rebuilt an engine, make in a new logbook if he chooses to use a new engine logbook? See Part 01, Section 270.

190. When mixture controls are used, must a suitable means be provided for simultaneous control of all engines on a two or multi-engin installation? See Part 03, Section 4802.

191. When more than one propeller is used, must separate controls be provided if propeller speed or pitc controls are provided? See Part 03, Section 4803.

192. What sort of a record is required to be attached to the airworthiness certificate? See Part 0 Section 12.

193. As used in the C.A.R., what meant by "Administrator"? See Part 98, Section 100.

194. Approximately at what point must carburetor de-icing fluid be introduced into the air induction system? See Part 03, Section 4501.

195. What dimensions are requirec finger strainers if used on fuel ta outlets? See Part 03, Section 4232

196. When an airworthiness certif cate is cancelled for any reason wh soever, must the registered owner s render the airworthiness to any off or special employee of the Administ tor? See Part 01, Section 22.

197. Must the oil tank outlets be free of any screen or other guard that may impede the flow of oil? See Part 03, Section 43123.

198. What is the status of an airworthinee certificate if an authorized inspector of the Administration (C.A.A. Inspector) refused to endorse the certificate after an inspection? Can the aircraft be legally flown at this time? See Part 01, Sections 13 and 24.

199. Is each liquid cooled engine equipped to be provided with an independent cooling system? See Part 03, Section 441.

200. May a registered owner of an aircraft request a cancellation of the airworthiness certificate? If so, does he make his request verbally or in writing? See Part 01, Section 26.

201. Must oil tank filler connections be marked? See Part 03, Section 43121.

202. What is a "Type" certificate? See Part 03, Section 03.

203. Are coolant tanks required with liquid cooling systems? See Part 03, Section 4410.

204. If an engine is rebuilt by a manufacturer, can he use a new logbook and if so, is the manufacturer required to enter the operational history of the engine prior to the date it was rebuilt? See Part 01, Section 270.

205. When are emergency fuel pumps required? See Part 03, Section 424.

206. Can a certificated aircraft mechanic make a periodic inspection of a certificated aircraft? If so, how does he record his findings? Must he state his certificate number in writing when making the report? See Part 01, Section 25.

207. Must fuel lines which are connected to component parts of the airplane between which relative motion may exist be provided with means of insuring flexibility? See Part 03, Section 425.

208. Does an Aircraft Operations Record prescribe limitations for safe flight operations? See Part 01, Section 12.

209. What are the Civil Air Regulations requirements regarding engine breather line? See Part 03, Section 434.

210. How often must a certificated aircraft receive a routine inspection by a person qualified to make the inspection? See Part 01, Section 25.

211. How many single strokes per minute are standard requirements for hand emergency pumps? See Part 03, Section 424.

212. Are coolant tanks required to be provided with expansion spaces? See Part 03, Section 4410.

213. Is the registered owner of a certificated aircraft responsible for the maintenance and safe keeping of a logbook for the aircraft and a logbook for each engine installed in the aircraft? See Part 01, Section 27.

214. Is an oil tank expansion space required for all oil tanks? See Part 03, Section 43120.

215. Can a person legally make periodic inspection of a certificated aircraft if he does not hold a currently effective mechanic certificate? See Part 01, Section 25.

216. Where is the nameplate located in the airplane? What information is required on the nameplate? See Part 03, Section 7.

217. What constitutes a repair? See Part 18, Section 41.

218. What regular C.A.A. form if any is used for Periodic Aircraft Inspection Reports? See Part 01, Section 25.

219. What is a certificated aircraft? See Part 03, Sections 00 and 02, and Part 01, Sections 10 and 14.

220. The airworthiness certificate of an aircraft denotes that the aircraft is in the "Normal" category. For what flight purposes may it be used? See Part 03, Section 01.

221. In regard to an aircraft propeller, what is considered a major change? See Part 14, Section 52.

222. What is an airworthiness certificate? See Part 01, Section 1 and Part 03, Sections 00 and 02.

223. Is it legal for a certificated aircraft to be operated in an apparent unsafe condition even though a C.A.A. inspector has not as yet made an airworthiness inspection since the unsafe condition has arisen? See Part 01, Section 24.

224. What constitutes a major repair? See Part 18, Section 31.

225. If a propeller has passed the regu United States military endurance tests and and is approved by the military forces, is it considered to have met C.A.A. airworthiness requirements? See Part 14, Section 04.

226. What constitutes a minor repair? See Part 18, Section 30.

227. Under what conditions is it permissible to deviate from the airworthiness requirements of C.A.R. Part 13, on Aircraft Engine Airworthiness? See Part 13, Section 11.

228. Are oil tank vents for acrobatic type airplanes required to be so designed and constructed as to prevent hazardous loss of oil during acrobatic maneuvers? See Part 03, Section 43122-A.

229. When is an aircraft registered as an aircraft of the United States? See Part 501, Section 2.

230. In regard to an aircraft propeller, what is considered a minor change? See Part 14, Section 53.

231. If an engine is equipped with an oil filter, must the oil filter be constructed or installed in such a manner that complete blocking of the oil flow through the filter element will not interfere with the continued operation of the engine oil supply system? See Part 03, Section 4323.

232. Is the flight time of a certificated aircraft required to be recorded and if so, where is it recorded and by whom? See Part 01, Section 27.

233. If finger strainers are used in the fuel tank outlet, must they be accessible for inspection and cleaning? See Part 0e, Section 42325.

234. When an airplane is involved in an accident and any person is seriously or fatally injured, can the aircraft or any part of it be moved or disturbed before being granted permission by the C.A.A? See Part 01, Section 310.

235. Must fuel lines be so installed and supported in a manner to prevent excessive vibration and to withstand extra loads due to fuel pressure and accelerated flight conditions? See Part 03, Section 425.

236. May aircraft logbooks and aircraft engine logbooks be dispensed with in the case of scheduled Air Carrier Aircraft, Aircraft Engines, or propellers by a suitable system acceptable to the Administrator? See Part 01, Section 27.

237. When fuel pumps are used, must at least one pump for each engine be driven directly by the engine? See Part 03, Section 424.

238. What precaution must be taken when installing landing lights? See Part 03, Section 5370.

239. What sort of protection is given members of the airplane structure in order to prevent corrosion, etc? See Part 03, Section 303.

240. If a life raft or life preserver is required, what type of equipment must be selected? See Part 03, Section 5440.

241. Are engines installed in cowls with cowl flaps required to be equipped with cylinder head temperature indicators? See Part 03, Section 5225.

242. May a landing gear wheel be equipped with any make or type of tire at the will of the operator? If so, what conditions must be met? See Part 03, Section 364.

243. What is meant by an Operation Test? See Part 03, Section 3560.

244. When fuses are used,, to what extent must spare fuses be provided? See Part 03, Section 5331.

245. Are inspection openings required? See Part 03, Section 304.

246. What are the requirements for the installation of landing lights? See Part 03, Section 537.

247. What are the installational requirements for rear position lights? See Part 03, Section 5381.

248. Who is declared eligible by the Civil Air Regulations to perform maintenance repair and alteration operations? What agencies are permitted to do this type of work? See Part 18, Section 50.

249. What are the standard requirements for connecting cables used in the installation of electrical equipment? See Part 03, Section 534.

250. What aeronautical knowledge does Civil Air Regulations Part 24 state is required of aircraft mechanics? See Part 24, Section 200.

251. If batteries are used and are of such a type that corrosive substance may escape during servicing or flight, must a means be provided to locate the battery in an enclosed compartment? See Part 03, Section 5300.

252. Should a certificated mechanic holding a currently effective parachute rigger rating repack a parachute which is obviously unsafe for use? See Part 24, Section 51.

253. Are protective devices such as fuses or circuit breakers required to be installed in the circuits to all electrical equipment? See Part 03, Section 533.

254. What are the installational requirements for forward position lights? See Part 03, Section 5380.

255. How many years of practical experience is required by C.A.A. by applicants for mechanic's certificate? See Part 24, Sections 201 and 211.

256. Must electrical systems be installed in such a manner that they are suitable protected from oil, fuel, water, etc? See Part 03, Section 53.

257. Must an instructor who has tutored an applicant who has failed in his examination of Civil Air Regulations supply a statement which shows the amount of instruction given and that he believes the applicant can now pass the examination? See Part 24, Section 36.

258. What installational requirements are to be met in regard to parachute flares? See Part 03, Section 5421.

259. Is a C.A.A. mechanic's certificate transferable? See Part 24, Section 31.

260. If flares are required, what Civil Air Regulations must be complied with? See Part 03, Section 5420.

261. If a mechanic's certificate has been in existence for 60 days to date and no notice has been received to the contrary, does the certificate continue in effect until the mechanic is otherwise notified by the C.A.B? See Part 24, Section 32.

262. What powerplant fire protection means is taken in connection with lines carrying inflammable fluids into the engine compartment? See Part 03, Section 49.

263. Must battery ignition systems be supplemented by a generator which automatically becomes available as a source of alternating electrical current in the event of battery failure? See Part 03, Section 4810.

264. Is a ground means, such as a stick gauge, required for oil tanks installed in an airplane? See Part 03, Section 5224.

265. When mixture controls are used, must a separate control be provided for each engine? See Part 03, Section 4802.

266. How far back of any opening in the engine compartment cowlings must all portions of the airplane be constructed of non-inflammable materials? See Part 03, Section 471.

267. If an airplane uses an oil transfer system or a reserve oil system, must means be provided to indicate to the flight crew the quantity of oil in each tank during flight? See Part 03, Section 5224.

268. Must ignition switches provide control for each ignition circuit on each engine? See Part 03, Section 4801.

269. Must a magnetic direction indicator be so installed that its accuracy will not be greatly affected by vibration or magnetic fields within the airplane? See Part 03, Section 5213.

270. What are the Civil Air Regulations requirements for fabric covering? See Part 03, Section 332.

271. What are the installation requirements for life rafts and life preservers? See Part 03, Section 5441.

272. What are the Civil Air Regulations requirements for the installation of safety belts? See Part 03, Section 543.

273. Must safety equipment for emergency use and the compartments where it is stored by appropriately marked? See Part 03, Section 540.

274. Must means be provided to prevent corrosive substances which may escape from the battery from coming in contact with other parts of the airplane? See Part 03, Section 5300.

275. Must the identifying symbols and registration numbers be permanently affixed to the aircraft? See Part 03, Section 71.

276. Must each fuel tank be provided with a drainable sump? See Part 03, Section 42321.

277. Are grommets or bushings required in necessary openings in firewalls? See Part 03, Section 4700.

278. Does the Civil Air Regulations permit fuel tank vents to terminate at points where the discharge of fuel from the vent outlet will constitute a fire hazard? See Part 03, Section 42323.

279. Who supplies all necessary equipment and personnel to block test an engine? See Part 13, Section 210.

280. Are fuel tank outlets required to be provided with screen strainers? See Part 03, Section 42325.

281. What internal test pressure must all oil tanks withstand? See Part 03, Section 4310.

282. Name several fuel tank vent constructional features which must be met in order to comply with the Civil Air Regulations. See Part 03, Section 42323.

283. What ground clearance is required on propeller tips when the airplane is in a horizontal position and the airplane weight is on the landing gear? See Part 03, Section, 4112.

284. What are the installation requirements for position lights on an airplane? See Part 03, Section 538.

285. Does the Administrator (C.A.A.) ever permit short time operation of a propeller at slight excess limits of power and speed? If so, what are the limits and conditions? See Part 14, Section 05.

286. If carburetors are equipped with vapor elimination connections, where must the vent line terminate? See Part 03, Section 42323.

287. Must fuel tank filler connections be so designed and installed as to prevent spilled fuel from entering into the fuel tank compartment or other portions of the airplane? See Part 03, Section 42322.

288. Must oil tanks be suitably vented? See Part 03, Section 43122.

289. What is an Approved Type Certificate? See Part 03, Section 031 and Part 02, Section 1.

290. Must fuel tank caps provided a fuel tight seal for the main filler opening? See Part 03, Section 42322.

291. Must a fuel tank be provided with pads to prevent chaffing between the tank and its supports? See Part 03, Section 4231.

292. Are suitably located drains required on each and every fuel system? See Part 03, Section 426.

293. What are the most important requirements of padding materials used in supporting fuel tanks? See Part 03, Section 4231.

294. Must fuel tank compartments be ventilated and drained? See Part 03, Section 4231.

295. Must all cowling and firewalls be designed and arranged in a manner so as to permit ready visual inspection for and removal of dirt accumulations? See Part 03, Section 40.

296. If a fuel tank is provided with a fuel expansion space, must it also be made impossible to inadvertently fill the tank expansion space when the airplane is in the normal ground attitude? See Part 03, Section 42320.

297. Are all powerplant controls and fuel system controls plainly marked as to their function and proper operation? See Part 03, Sections 500 and 611.

298. If a sediment bowl is incorporated in a fuel tank installation, must it be so installed as to permit visual ground inspection? See Part 03, Section 42321.

299. What is a periodic inspection and who may make such an inspection? See Part 01, Section 25.

300. If a battery is used for an engine ignition system, must a means be provided to warn the flight personnel of any malfunctioning of any part of the igntion system causing a continuous discharge of the battery? See Part 03, Section 4810.

301. Can aircraft which are operated in scheduled air transportation service be inspected by means of special forms acceptable to the Administrator? Must this inspection be made by an appropriately certificated aircraft mechanic? If so, how does he record his findings and attest his entries on the records? See Part 01, Section 25.

302. Must the servo control devices used with automatic pilot systems be so designed that they ca be positively disconnected when necessary or be overpowered by the human pilot? See Part 03, Section 5214.

303. Are accidents to Civil Aircraft or certificated aircraft reported verbally or in writing and how would you as a pilot or operator report an accident which results in fatal injury to a person? See Part 01, Section 30.

304. Is it necessary that an aircraft engine manufacturer supply a new logbook with an engine which he has rebuilt? See Part 01, Section 270.

305. Why are all instruments which are provided with air case connections vented? See Part 03, Section 512.

306. What is a production certificate? See Part 02, Section 20.

307. Name several metals which are used in firewall construction. See Part 03, Section 452.

308. Must induction fuel system ducts be provided with drains which will prevent the accumulation of fuel or moisture in all normal ground and flight attitudes? See Part 03, Section 452.

309. If induction system ducts are connected to component parts of the airplane, must provision be made for flexibility between the duct and the airplane structure? See Part 03, Section 452.

310. What general methods of fabrication are recommended for airplane structures? See Part 03, Section 302.

311. Must the exhaust system be so constructed and arranged as to assure the safe disposal of exhaust gases? See Part 03, Section 46.

312. Must spaces adjacent to fuel tanks be ventilated? See Part 03, Section 4231.

313. When is it permissible to use springs in the control system? See Part 03, Section 3573.

314. May drains for induction system ducts discharge in a location which may cause a fire hazard? See Part 03, Section 452.

315. Are drains required in all liquid cooling systems? See Part 03, Section 4412.

316. How is the existence of points of excessively high temperatures prevented in exhaust system components? See Part 03, Section 46.

317. What materials are required for the construction of exhaust manifolds? See Part 03, Section 460.

318. If recessed coolant filler connections are used, must they be draine clear of all portions of the airplane? See Part 03, Section 44102.

319. What dimensions are required of coolant inlet and outlet lines? See Part 03, Section 4411.

320. Are all accidents involving aircraft occurring within the United Stat required to be reported promptly to th nearest Civil Aeronautics Administrati (C.A.A.) office? If so, how is the accident reported and who is required to report the accident? See Part 01, Section 30.

321. How long does an airworthiness certificate remain in effect? See Part 01, Section 13.

322. What pressures are integral type fuel tanks required to withstand? See Part 03, Section 4230.

323. What type of work can be performed by a holder of a factory mechanic's rating and must the holder confine his activities to the products manufactured by his employer? See Part 24, Section 53.

324. At what date after making application is an aircraft said to be registered by the Administrator (C.A.A See Part 501, Section 22.

325. Does an applicant for a C.A.A. mechanic certificate make a formal application to C.A.A. on a specific form prescribed and furnished by the Administrator? See Part 24, Section 30.

326. Are the fuel systems on multi-engine airplanes so arranged as to permit operation in such a manner that the failure of any one component will not result in the loss of power of more than one engine? See Part 03, Section 4210.

327. Must certificated engines be installed in certificated aircraft? See Part 03, Section 410.

328. What engine speed limitations are placed on variable pitch propellers with constant speed controls? See Part 03, Section 41112.

329. Must a C.A.A. certificated mechanic keep his mechanic certificate readily available for inspection upon the reasonable demand of any person? See Part 24, Section 31.

330. How much longitudinal clearance is required between propeller blades or cuffs and stationary portions of the airplane? See Part 03, Section 4412.

331. On multi-engine airplanes must the identical powerplant controls be so located as to prevent any misleading impression regarding the engines to which they relate? See Part 03, Section 3802.

332. What three type of tests are given by C.A.A. to applicants for C.A.R. mechanic's certificates in order to determine the applicant's aeronautical skill? See Part 24, Sections 202 and 212.

333. Is a C.A.A. certificated aircraft engine mechanic permitted by the C.A.R. to work on the aircraft structure or do riggining, etc? See Part 24, Section 50.

334. What provisions must be made to prevent the contents of cargo compartments from becoming a hazard by shifting: See Part 03, Section 3823.

335. Are leveling marks provided in the airplane for leveling the airplane on the ground? See Part 03, Section 390.

336. Must certificated repair stations, making a major repair or a major alteration on an aircraft, aircraft engine or propeller, make a detailed report to the Administrator on standard forms required for reporting major repairs or major alterations on aircraft, aircraft engines or propellers? If so, what are they like? See Part 18, Section 51 and 531.

337. Must provision be made for visual inspection at all fairleads, pulleys, terminals, turnbuckles, etc? See Part 03, Section 3571.

338. When retractable landing wheels are used, must means be provided for indicating to the pilot when the wheels are secured in an up or down position? See Part 03, Section 3622.

339. After an applicant for a C.A.A. mechanic certificate or rating has failed to pass an prescribed theoretical, practical examination or test, may he again make application at a later date? If so, how many days must elapse before he can again make application? Name the conditions under which it is possible to again make application. See Part 24, Section 50.

339. Must the engine breather lines for acrobatic type of airplanes be so arranged as to prevent excessive loss of fuel during acrobatic maneuvers? See Part 03, Section 434-A.

340. Are master switches required when electrical equipment is installed? See Part 03, Sections 532 and 5320.

341. What are the requirements for use of flexible hose in fuel lines? See Part 03, Section 425.

342. Must you, as an operator of an aircraft, promptly obey an order from the C.A.A. to preserve and remove to a place of safekeeping for the purpose of inspection or test, any aircraft or parts involved in a serious accident? See Part 01, Section 31.

343. What are the requirements for coolant tank installations? See Part 03, Section 44101.

344. Who is an operator of an aircraft? See Part 01, Section 30.

345. Under what conditions may primary and alternate air intakes open within the cowling? See Part 03, Section 45.

346. May exhaust gases be discharged at locations which will cause a glare affecting pilot visibility at night? See Part 03, Section 46.

347. Are coolant tank filler connections required to be appropriately marked? See Part 03, Section 44102.

348. Must fuses be so located as to be replaceable in flight? See Part 03, Section 5330.

349. Are cowlings required to be constructed of non-inflammable materials? See Part 03, Section 471.

350. If the engine coolant is inflammable, must the air intake duct to the coolant radiator be so located that flames coming from the engine nacelle, in case of fire, cannot strike the radiator? See Part 03, Section 44111.

351. What mesh screen is required for all fuel tank outlets? See Part 03, Section 42325.

352. Are engine induction systems provided with a means of preventing and eliminating ice accumulations? See Part 03, Section 450.

353. Are throttle controls always arranged so that a forward movement opens the throttle? See Fig 03-14.

354. Must adequate ventilation be provided for the carburetor air preheater? See Part 03, Section 451.

355. What material is required for all powerplant cowling and engine side of the firewall? See Part 03, Section 470.

356. How many separate air intakes are required on engines not equipped with a fuel injector? See Part 03, Section 45.

357. Is a firewall required on every airplane engine installation? See Part 03, Section 470.

358. Are all fuel gauges installed so as to readily indicate fuel quantities to the pilot or flight mechanic? See Part 03, Section 5222.

359. Are suitable drains required in all oil lines? See Part 03, Section 433.

360. Must preheaters be so construct as to permit inspection of the preheater and also of the exhaust manifold parts which it surrounds? See Part 03, Section 451.

361. Under what conditions may a single source of air intake be provided on engines equipped with a fuel injector? See Part 03, Section 45.

362. Is a positive, quick-acting fuel shut-off valve required for each fuel line? See Part 03, Section 4251.

363. Must fuel tank vents for acrobatic type airplanes be so constructed as to prevent fuel from syphoning from the vent during maneuvers? See Part 03, Section 42324.

364. Are fuel tanks required to be provided with an expansion space if the tank vent discharges clear of the aircraft? See Part 03, Section 42320.

365. Must compartments which are integral parts of the airplane structure and adjacent to fuel tanks be ventilated and drained? See Part 03, Section 4231.

366. Where is the placard containing the calibration readings of a magnetic direction indicator to be locate See Part 03, Section 6101.

367. Must carburetor air intakes be provided with suitable drains and with all openings completely outside the cowlings? See Part 03, Section 452.

368. In what manner must instrument lights be installed? See Part 03, Section 5360.

369. What is the recommended location for flashing rear position flashing lights? See Part 03, Section 5381.

370. What are representative instrument markings? See Fig 04-15.

371. Are fuel strainers required in each fuel line between a tank or tanks and a carburetor? See Part 03, Section 4252.

372. What minimum clearance must be maintained between a firewall and any fuel tank? See Part 03, Section 4231.

373. What information is required on placards relating to baggage compartments? See Part 03, Section 6120.

374. Is it necessary to properly vent an enclosure which contains a battery and to provide drains for spilled liquid? See Part 03, Sections 5300 and 5301.

375. Where must the placard relating to an emergency exit be located? See Part 03, Section 6122.

376. What are the size requirements for coolant lines, fittings and accessories? See Part 03, Section 4411.

377. What is meant by block-testing an engine? See Part 13, Section 21.

378. What oil supply capacity or oil fuel supply ratio is required for all systems? See Part 03, Section 43.

379. Must cooler tank filter connections be provided with a means of preventing the entrance of spilled coolant into the coolant tank compartment? See Part 03, Section 44102.

380. Must portions of the exhaust manifold which are connected to component parts of the airplane and the engine incorporate provisions for flexibility? See Part 03, Section 460.

381. What color of the arc on the face of powerplant instruments indicates the normal operating ranges? See Part 03, Section 6102.

382. What are the Civil Air Regulations for marking and installational requirements for instruments (cockpit) having an important and direct bearing on safe operation? See Part 03, Section 610.

383. What is an aircraft accident as defined by the Civil Air Regulations? See Part 01, Section 33.

384. What color and markings are required on emergency controls? See Part 03, Section 6112.

385. Are standard forms used to report aircraft accidents? See Part 01, Section 30.

386. How are powerplant fuel controls marked? See Part 03, Section 6111.

387. What general factors govern the choice of material used in the airplane structure? See Part 03, Section 301.

388. Are stops required on all control surfaces? See Part 03, Section 354.

389. Is each baggage or cargo department and ballast department required to be plainly placarded? See Part 03, Section 6120.

Appendix

CIVIL AERONAUTICS ADMINISTRATION GENERAL INSPECTION OFFICES

REGION NO. I

Address	Tel.No.
General Inspection District Office Civil Aeronautics Administration Albany Airport, Watervliet, New York	Albany 2-6517
General Inspection District Office Civil Aeronautics Administration Allentown-Bethlehem Airport Allentown, Pennsylvania	Catasa- qua 851
General Inspection District Office Civil Aeronautics Administration Buffalo Airport, Buffalo, New York	Humboldt 6872
General Inspection District Office Civil Aeronautics Administration Benedum Airport Clarksburg, West Virginia	Clarks- burg 818
General Inspection District Office Civil Aeronautics Administration Municipal Airport, Concord, New Hampshire	Concord 3967
General Inspection District Office Civil Aeronautics Administration Municipal Airport, Hagerstown, Md.	Hagers- town 3524
General Inspection District Office Civil Aeronautics Administration Harrisburg State Airport New Cumberland, Pennsylvania	Harri burg 4-584
General Inspection District Office Civil Aeronautics Administration 40 Exchange Place, New York 5, N.Y.	White- hall 4-27
General Inspection District Office Civil Aeronautics Administration Allegheny County Airport Pittsburgh, Pennsylvania	Home- stead 2726
General Inspection District Office Civil Aeronautics Administration Woodrum Field, Roanoke, Virginia	Roan- oke 1841
General Inspection District Office Civil Aeronautics Administration Municipal Airport Syracuse, New York	Syrac 8-30
General Inspection District Office Civil Aeronautics Administration Barnes-Westfield Municipal Airport Westfield, Massachusetts	Westf 230

REGION NO.II

Address	Tel.No.
General Inspection District Office Civil Aeronautics Administration Municipal Airport Birmingham, Alabama	9-2522
General Inspection District Office Civil Aeronautics Administration P. O. Box 929, Charlotte, N. C.	8063
General Inspection District Office Civil Aeronautics Administration Box 1085, Columbia, South Carolina	8414
General Inspection District Office Civil Aeronautics Administration Room 205, Medical Bldg., Box 197 Jackson, Missippi	3-4429
General Inspection District Office Civil Aeronautics Administration 705-707 Lynch Building Jacksonville, Florida	5-31
General Inspection District Office Civil Aeronautics Administration Municipal Airport, Administration Building, Memphis, Tennessee	9-80
General Inspection District Office Civil Aeronautics Administration American Title & Insurance Company Bldg., 37 N.E. 1st Ave., Miami, Fla.	
General Inspection District Office Civil Aeronautics Administration Municipal Airport, Nashville, Tennessee	5-5

Address	Tel.No.
eral Inspection District Office ivil Aeronautics Administration oom 916, Insurance Building aleigh, North Carolina	6160
eral Inspection District Office ivil Aeronautics Administration ew Orleans Airport, New Orleans, La.	Crescent 5474
General Inspection District Office Civil Aeronautics Administration P. O. Box 2112 Peter O. Knight Airport Tampa, Florida	H-1419

REGION NO. III

Address	Tel.No.
eral Inspection District Office ivil Aeronautics Administration 200 South Cicero Avenue hicago 38, Illinois	Portsmouth 8608
eral Inspection District Office ivil Aeronautics Administration unken Airport, incinnati 26, Ohio	East 7171
eral Inspection District Office ivil Aeronautics Administration leveland Airport, Cleveland, O.	Clearwater 6160
eral Inspection District Office ivil Aeronautics Administration oom 208-210, Administration Bldg. ort Columbus Airport olumbus 3, Ohio	Evergreen 7561
eral Inspection District Office ivil Aeronautics Administration ord Airport, Box 106 earborn, Michigan	Dearborn 4100
eral Inspection District Office ivil Aeronautics Administration arks Airport ast St. Louis, Illinois	East 6520
eral Inspection District Office ivil Aeronautics Administration oom 211, Walker Building 21 First Avenue, North argo, North Dakota	5035
General Inspection District Office Civil Aeronautics Administration Kent County Airport Grand Rapids, 8, Michigan	5-4181
General Inspection District Office Civil Aeronautics Administration Bowman Field, Administration Bldg. Louisville 5, Kentucky	Highlan 0713
General Inspection District Office Civil Aeronautics Administration Municipal Airport Indianapolis 44, Indiana	Belmon 1722
General Inspection District Office Civil Aeronautics Administration General Mitchell Field, Route 2 Milwaukee 7, Wisconsin	Sherida 0766
General Inspection District Office Civil Aeronautics Administration 1304 Foshay Tower Building Minneapolis, Minnesota	Geneva 7821
General Inspection District Office Civil Aeronautics Administration Room 508, Odd Fellows Building 103 South Main Street South Bend 8, Indiana	4-8720
General Inspection District Office Civil Aeronautics Administration Municipal Airport Springfield, Illinois	35266

REGION NO. IV

Address	Tel.No.
eral Inspection District Office ivil Aeronautics Administration 910 East Central Avenue lbuquerque, New Mexico	2-5311
General Inspection District Office Civil Aeronautics Administration Room 333, Amarillo Building Amarillo, Texas	9481

REGION NO. IV Cont'd

Address	Tel.No.	Address	Tel
General Inspection District Office Civil Aeronautics Administration Room 241, Terminal Building Dallas, Texas	Dixon 4-2040	General Inspection District Office Civil Aeronautics Administration P. O. Box 426, Little Rock, Ark.	2-3
General Inspection District Office Civil Aeronautics Administration Municipal Airport, El Paso, Texas	Main 2640 Ext. 23	General Inspection District Office Civil Aeronautics Administration 913 Colcord Building Oklahoma City, Oklahoma	7-8
Gemeral Inspection District Office Civil Aeronautics Administration Meacham Field, Fort Worth 1, Tex.	6-2141	General Inspection District Office Civil Aeronautics Administration 1706 Transit Tower San Antonio 5, Texas	Fan 74
General Inspection District Office Civil Aeronautics Administration Municipal Airport, Houston, Tex.	Wydown 9-1286	General Inspection District Office Civil Aeronautics Administration P. O. Box 86, Shreveport, La.	2-6
General Inspection District Office Civil Aeronautics Administration c/o Lou Foote Flying Service Lancaster, Texas		General Inspection District Office Civil Aeronautics Administration P. O. Box 2527, Tulsa, Oklahoma	6-8

REGION NO. V

Address	Tel.No.	Address	Tel
General Inspection District Office Civil Aeronautics Administration Municipal Airport, Cheyenne, Wyoming	8141	General Inspection District Office Civil Aeronautics Administration Municipal Airport Kansas City 6, Missouri	Nor 3
General Inspection District Office Civil Aeronautics Administration Stapleton Airport Denver 7, Colorado	East 1871	General Inspection District Office Civil Aeronautics Administration 726 Terminal Building 10th & "O" Streets, Lincoln 1, Neb.	2-6
General Inspection District Office Civil Aeronautics Administration 311 Old Federal Building Des Moines 9, Iowa	4-4770	General Inspection District Office Civil Aeronautics Administration Box 127, Lambert Field Branch St. Louis 21, Missouri	Ave 33
General Inspection District Office Civil Aeronautics Administration Municipal Airport Huron, South Dakota	4245	General Inspection District Office Civil Aeronautics Administration Room 106, Broadview Hotel Wichita, Kansas	5-5

REGION NO. VI

Address	Tel.No.	Address	Tel
General Inspection District Office Civil Aeronautics Administration Chandler Field, Fresno, Calif.	Fresno 2-1810	General Inspection District Office Civil Aeronautics Administration 306 North Vermont Avenue Los Angeles 4, California	Nor 1
General Inspection District Office Civil Aeronautics Administration Municipal Airport Oakland 14, California	Sweet- wood 5711	General Inspection District Office Civil Aeronautics Administration Sky Harbor Airport, P.O. Box 992 Phoenix, Arizona	3-

REGION NO. VI Cont'd

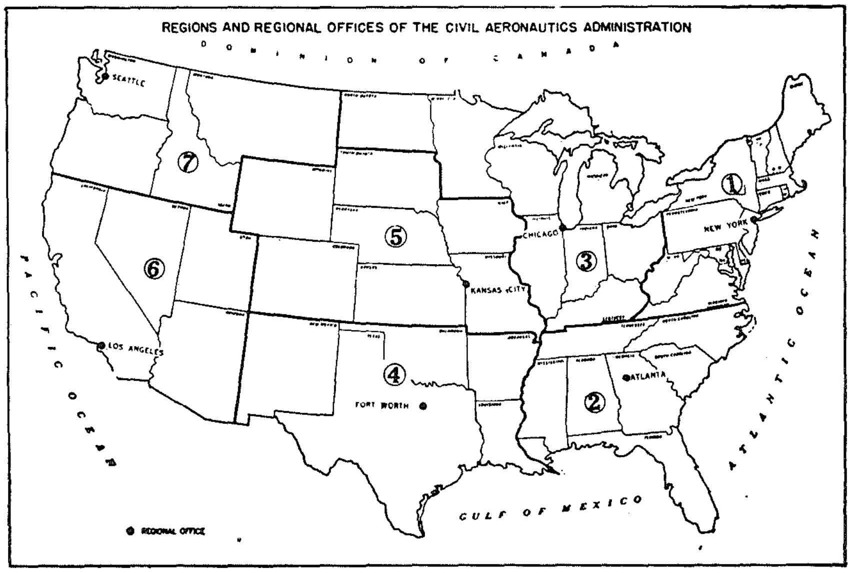
Address	Tel.No.	Address	Tel.No.
eral Inspection District Office ivil Aeronautics Administration ox 499, Reno, Nevada	Sparks 5-f-2	General Inspection District Office Civil Aeronautics Administration Municipal Airport Salt Lake City 13, Utah	5-3930

REGION NO. VII

Address	Tel.No.	Address	Tel.No.
eral Inspection District Office ivil Aeronautics Administration oeing Field, Seattle 8, Wash. Mail address: . O. Box 3224 eattle 14, Washington	Lander 5540	General Inspection District Office Civil Aeronautics Administration Boise Municipal Airport Boise, Idaho	311
eral Inspection District Office ivil Aeronautics Administration ilot Butte Inn end, Oregon	295	General Inspection District Office Civil Aeronautics Administration Helena Municipal Airport, P. O. Box 1167, Helena, Montana	3311
eral Inspection District Office vil Aeronautics Administration avid Fratt Building illings, Montana	7910	General Inspection District Office Civil Aeronautics Administration P.O. Box 26, Parkwater, Washington	Lakeview 2370
		General Inspection District Office Civil Aeronautics Administration 1016 Larson Bldg., Yakima, Wash.	22873

REGION NO. VIII

Address	Tel.No.
eral Inspection District Office ivil Aeronautics Administration . O. Box 790, Fairbanks, Alaska	East 289



Form 319

UNITED STATES OF AMERICA
DEPARTMENT OF COMMERCE
CIVIL AERONAUTICS ADMINISTRATION
WASHINGTON

PERIODIC AIRCRAFT INSPECTION REPORT

________________ (Identification mark)
________________ (Serial number)
________________ (Date)
________________ (Recommendation)

________________________________ (Owner)
________________________________ (Make and model)

CERTIFICATES:
Is Registration Certificate in aircraft? ____________ In name of owner above ____________
Is Airworthiness Certificate in aircraft? ______ Effective until ____________

LOG BOOKS:
Is aircraft log book available? ____________ Current and in proper condition ____________
Is log book for each engine available? ____________ Current and in proper condition ____________
Has proper entry of this inspection been made in the appropriate log book? ____________

GENERAL CONDITION AND INFORMATION:
Do the aircraft and power plant indicate satisfactory maintenance and repair? ____________
Are aircraft, power plant, and power-plant compartments thoroughly cleaned? ____________
Are sufficient and adequate inspection openings provided? ____________
CARGO COMPARTMENTS (location and *placarded* capacity) ____________
____

FUEL TANKS (location and *marked* capacity) ____________
____
OIL TANKS (number and *marked* capacity) ____________
OCCUPANTS (number of seats and safety belts for which certificated) ____________
ENGINES (number installed—make and model of each) ____________
PROPELLERS (make and model of hubs and blades) ____________

UPON INSPECTION OF THE FOLLOWING LISTED ITEMS AND UNITS, EXCEPT WHERE MORE SPECIFIC INFORMATION IS REQUESTED, THE CONDITION WILL BE INDICATED AS:

Airworthy by check mark "√," Unairworthy by the sign "X." If indicated as "Unairworthy," explain reasons therefor under remarks.

(Strike out items not applying to the aircraft being inspected)

POWER PLANT (indicate condition of the following):
Engine throughout range of operating r. p. m. ____________
Engine installation ______ Speed ring ______ Cowling ______ Attachment ______
Engine assembly bolts, studs, and safety devices ____________
Magnetos ______ Ignition cables ______ Ground wires ______ Spark plugs ______
Booster ______ Wiring ______ Ground ______ Starter ______ Generator ______ Shielding ______
Exhaust collector ring ______ Exhaust stack ______ Engine radiator ______ Oil radiator ______ Carburetor heater ______ Cabin heater ______ Heater valves and control units ______ Fuel drains ______ Oil drains ______ Drains safetied ______
Controls for engine accessories and appliances ____________
Any openings through firewall permitting fumes to enter cockpit or cabin ____________
REMARKS: ____________
Propellers ______ Installation ______ Alinement ______ Controls ______ Condition ______
REMARKS: ____________
____
____

16—8179

ENGINE NACELLES (indicate condition of the following):

Engine mount ________ Ring ________ Bearers ________ Fittings ________ Attachment ________
Welds ________ Bolts ________ Rivets ________ Rubber dampers ________
Any indication of rust ________ Corrosion ________ Damaged structure ________

COCKPIT (indicate condition of the following):

Seats ________ Safety belts ________ Fire extinguishers ________ Windows ________ Windshield ________
Power-plant instruments ________ Are they properly marked? ________ Operate properly? ________
Flight instruments ________ Are they properly marked? ________ Ignition switches ________
Instrument lights ________ Fuses ________ Spare fuses ________ Fuses marked ________
Emergency exit ________ Door with lock to passenger compartment ________
Is pressure extinguisher installed? ________ Operating ________ Full ________
Control marked ________ Flare control properly marked ________
Remarks: ________

CONTROLS (indicate condition of the following):

Engine controls ________ Propeller controls ________ Properly marked? ________ Friction locks ________
Control columns, sticks ________ Rudder bar, pedals ________ Control linkage ________
Cables ________ Bell cranks ________ Guides ________ Pulleys ________ Retainers ________
Sprockets ________ Bolts and clevises ________ Properly mounted and safetied? ________
Any looseness, binding, chafing, or interference in operation of controls? ________
Are stops provided for all controls? ________ Stabilizer, flap and tab controls ________
Properly marked for position and direction of control? ________
Worn or cracked bolts or fittings ________
Remarks: ________

FUEL SYSTEM (indicate condition of the following):

Tanks securely mounted ________ Any signs of leakage? ________ Caps properly marked ________
Sumps drained and safetied ________ Vents open ________ Hose connections ________
Any sharp bends in fuel lines? ________ Lines properly supported ________ Signs of chafing ________
Grommet or liner through firewall ________ Sediment trap and strainer drained and safetied ________
Hose liners installed ________ Lines properly annealed ________
Fuel gages marked and working ________ Valves marked and working ________ Any leaks? ________
Fuel dumping mechanism operating properly ________ Properly marked ________
Filler necks protected to prevent gas overflow entering structure ________
Oil tanks securely mounted ________ Caps properly marked ________ Connections ________
Lines properly supported ________ Any indications of excessive oil leakage? ________
Oil radiator ________ Drain safetied ________
Remarks: ________

PASSENGER COMPARTMENT (indicate condition of the following):

Seats ________ Safety belts ________ Windows ________ Ventilation ________ Heater controls ________
Fire extinguishers ________ First aid kit ________ Emergency exits ________
Gas fumes ________ Door hinges ________ Latch ________
Remarks: ________

UNDERCARRIAGE (indicate condition of the following):

Shock units ________ Axles ________ Struts ________ Wheels ________ Tires ________ Pants ________
Fairing ________ Brakes ________ Brake cables, rods, and connections ________ Controls ________
Locking device ________ Fittings ________ Bolts, nuts, and clevises ________ Safetied ________
Signs of looseness or excessive wear in bolts and fittings ________
Retracting mechanism ________ Operating satisfactorily ________ Properly marked ________
Limit gages and warning signals operating and properly marked ________
Evidence of rust, corrosion, bends, dents, or other damage ________ Alinement ________
Was aircraft hoisted for checking condition of undercarriage? ________
Remarks: ________

FUSELAGE (indicate condition of the following):

Covering .... Protective application .... Tubing .... Structure .... Bulkheads ....
Floor .... Landing gear fittings .... Wing fittings .... Tail surface
fittings .... External brace fittings .... Engine mount attachment fittings ....
Tail wheel or skid fittings .... Welding .... Bolts .... Rivets ....
Cracked, loose, or worn fittings .... Signs of rust, corrosion, bends, dents, or other damage to structure ....
Wrinkles in covering .... Acid or excess oil on belly .... Adequate open drains provided ....
Rotten wood in structure .... Trash collected in tail .... Proper protective application to structure ....
REMARKS: ....

TAIL WHEEL OR SKID (indicate condition of the following):

Shock strut .... Wheel .... Skid .... Fittings .... Tire ....
REMARKS: ....

WINGS (indicate condition of the following):

Left upper ....
Left lower ....
Right upper ....
Right lower ....
Spars .... Ribs .... Compression members .... Drag trussing .... Fittings ....
Bolts .... Rivets .... Internal structure .... Protective application ....
Glue .... Leading edge .... Trailing edge .... Wing tip former ....
Covering .... Finish .... Sewing .... Rib stitching .... Drains and grommets ....
External bracing .... Flying and landing wires .... Fittings ....
Bolts .... Pins .... All holes properly repaired ....
Signs of rust, corrosion, dents, wrinkles, or other damage .... Position lights ....
Landing lights .... Wiring .... Lights properly mounted and secured ....
Operate satisfactorily ....
REMARKS: ....

AILERONS AND FLAPS (indicate condition of the following):

Left upper ....
Left lower ....
Right upper ....
Right lower ....
Spars .... Ribs .... Internal bracing .... Glue .... Bolts ....
Rivets .... Protective application .... Cover .... Drains and grommets ....
Hinges .... Leading edge .... Trailing edge .... Horns ....
Actuating mechanism .... Any signs of rust, corrosion, wood rot? ....
Wrinkles, bends, dents, or other signs of damage .... Condition of finish ....
REMARKS: ....

TAIL SURFACES (indicate condition of the following):

Stabilizer ....
Vertical fin ....
Rudder ....
Elevators ....
Spars .... Ribs .... Internal structure and bracing .... Protective application ....
Glue .... Bolts .... Rivets .... Covering .... Drains and grommets ....
Protective application and finish .... Hinges .... Horns .... Fittings ....
External braces .... Actuating mechanism .... Adjusting mechanism ....
Any signs of rust, corrosion, or wood rot? .... Wrinkles, bends, dents, or other signs of damage ....
Bolts, nuts, pins, and rivets .... Safetied ....
REMARKS: ....
....
....
....

FLOATS AND SKIS (indicate condition of the following):

Skis ________ Material ________ Braces ________ Shock devices ________ Pedestal ________
Fittings ________ Bolts, nuts, and rivets ________ Alinement ________
Floats ________ Material ________ Internal structure ________ Protective application ________
Bolts, nuts, pins, rivets ________ External braces ________ Fittings ________ Cables ________
Rudders ________ Controls ________ External protective application ________
Any signs of rust, corrosion, wood rot? ________ Wrinkles, bends, dents, or other signs of damage ________
REMARKS: ________

MISCELLANEOUS (indicate condition of installation and maintenance of following):

Battery ________ Battery box ________ Drain ________ Vent ________
Adjacent protective application on structure ________ Flares ________ Installation ________
Controls ________ Number ________ Type ________ Lights ________ Wiring ________
Conduits ________ Switches ________ Markings ________ Antenna ________ Type ________
Bonding ________ Shielding ________ Loop ________ De-icers ________ Where installed? ________
____
Number of seats having parachutes installed therein ________ Parachutes were last packed ________
Is wobble pump installed? ________ Operating satisfactorily? ________
Accessories, such as: Radio receiver, transmitter, etc., properly installed and secured ________
Are required equipment and accessories installed in accordance with provisions of Part 04 of the C. A. R., for the classification of certificate issued? ________
REMARKS: ________

REPAIR AND ALTERATION:

Have all replacements and repairs recommended as a result of this inspection been made in a satisfactory manner? ________ Describe: ________
____
____

Describe any other major repairs or replacements made to this aircraft since last inspected by a Civil Aeronautics Inspector ________
____
____

Describe any structural or equipment alterations which may have been made to this aircraft since last inspected by a Civil Aeronautics Inspector ________
____
____

Conformity of the above is established by ________
____

Properly executed forms and information covering repairs and alterations listed above are attached ________
Were submitted to ________ Date ________

This inspection was conducted for the following reason:

Endorsement for continuation of certificate ☐
Endorsement following major repair ☐
Endorsement following major alteration ☐
At request of an inspector of the C. A. A. ☐
100-hour periodic inspection ☐

____
(Signature of mechanic)

____
(Rating and certificate number)

No copy required. Signed form to be turned over to aircraft owner or operator, or if Certificate is to be endorsed, submit to an inspector of the Civil Aeronautics Administration.

Additional sheets may be attached hereto where more space is required.

Identification mark.

60.320 Location for display. The identification mark on conventional aircraft shall be displayed, in the case of a biplane, on the lower surface of the lower left wing and on the upper surface of the upper right wing and, in the case of a monoplane, on the lower surface of the left wing and the upper surface of the right wing: *Provided,* That if the length of the lower left wing of a biplane is less than one-half the length of the upper left wing, the identification mark shall be displayed on the lower surface of the upper left wing as far to the left as possible. The top of the letters and figures shall be toward the leading edge. The height shall be at least four-fifths of the mean chord but need not exceed 30 inches. The mark shall also be located on both sides of the vertical tail surface of all conventional airplanes, of a size as large as a 2-inch margin will permit. On gliders the letters and figures shall be displayed in the same manner and place prescribed for conventional airplanes except the minimum height shall be 15 inches. On aircraft other than conventional airplanes or gliders or on conventional aircraft where the design or dimensions of the wing prevent the display of the identification mark in the manner prescribed in these regulations, the identification mark shall be displayed in a manner satisfactory to the Administrator.

60.321 Lettering. The width of the letters and figures (except the figure 1) shall be at least two-thirds of their height. The width of each stroke shall be at least one-sixth of the height of the letters and figures, which shall be of uniform size. The space between such letters and figures shall be not less than one-sixth of the height. Such letters and figures shall be painted on the aircraft in a solid color and on a clearly contrasting background. Such identification mark shall be kept clean and clearly visible. No other design, mark, or symbol which might modify or confuse the assigned mark shall be placed on the aircraft except with the approval of a duly authorized inspector of the Administrator.

60.322 Military insignia. No aircraft, other than aircraft of the national defense forces of the United States, shall be operated with emblems, insignia, or markings of the national defense forces unless written authorization for such use is obtained from the War or Navy Departments.

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AERONAUTICAL INSTRUCTORS *and* STUDENT

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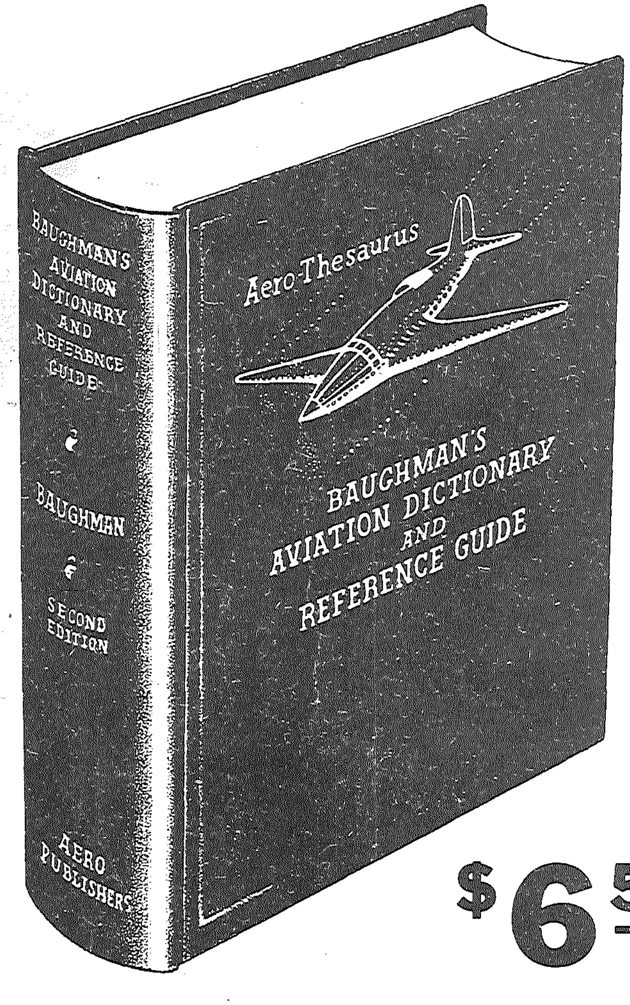
and REFERENCE GUIDE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